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ASSESSMENT OF THE AUTOMOTIVE INSPECTION, MAINTENANCE, AND REPAIR INDUSTRY

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16. Abstract The Automobile Transportation System is presently undergoing profound changes as a direct result of increasing cost and shortage of fossil fuels, the need to protect general resources, the environment, and public health and safety. Related legislation has changed and will continue to change automobile design drastically.

The Inspection/Maintenance/Repair Industry assumes a major role in the Automobile Transportation System. Aside from this industry's economic significance, it must also safeguard the considerable efforts vested in the design and production of fuel efficient, safe and pollution-free automobiles, while at the same time keeping the automobile expenses for the consumer at reasonable levels. As generally recognized, this represents a major logistical, technical, and financial challenge to concerned segments of industry and government.

This study describes the current status of the Inspection/Maintenance/Repair Industry in the U.S., the impact of technological changes and legislation, and related approaches used in Germany and Sweden.

Based on these findings suggestions are provided regarding:

- Responsibilities and authorities of automobile manufacturers, trade channels, consumers and appropriate government agencies
- Related research and development required
- Approaches toward realization of the suggestions.

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PREFACE

Because of the poor availability of up-to-date and consistent data pertaining to the I/M/R industry, it was necessary to rely instead on discussions with officials affiliated with the manufacturers, I/M/R trade associations, educational and training organizations, and many others. These officials not only gave their time and offered their thoughts, but in many cases followed up with written material that they and their staff prepared in support of this study.

We wish to offer our sincere thanks to all those who assisted us in the preparation of this report. We are expecially indebted to the following organizations:

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* Because of the competitive nature of the information provided, these firms are not individually identified.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

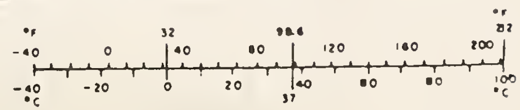

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF TABLES (CONT.)

LIST OF TABLES (CONT.)

LIST OF ABBREVIATIONS

AAA	American Automobile Association
AECS	Advanced Electronic Control Systems
AZT	Allianz Zentrum für Technik GmbH
ADAC	Allgemeiner Deutscher Automobil Club
AAMVA	American Association of Motor Vehicle Administrators
ANSI	American National Standards Institute
ASC	Automotive Service Council
AUTO-CAP	Automotive Consumer Action Program
AVA	American Vocational Association
DIDP	Diagnostic Inspection Demonstration Projects
DMVI	Diagnostic Motor Vehicle Inspection
DOT	Department of Transportation
EPA	Environmental Protection Agency
FMVCP	Federal Motor Vehicle Control Program
FTC	Federal Trade Commission
GAO	General Accounting Office
HEW	Health, Education and Welfare (Department of)
I/M	Inspection Maintenance
IMR	Inspection/Maintenance/Repair
ITB	Institut für technische Betriebsführung
MM	Magnuson-Moss (Consumer Warranty Act)
MVMA	Motor Vehicle Manufacturers Association
NAAQS	National Ambient Air Quality Standards
NASS	National Accident Sampling System
NATTS	National Association of Trade and Technical Schools
NADA	National Automobile Dealers Association
NIASE	National Institute for Automotive Service Excellence
NHTSA	National Highway Traffic Safety Administration
OEM	Original Equipment Manufacturer
OJT	On the Job Training
PMVI	Periodic Motor Vehicle Inspection

LIST OF ABBREVIATIONS (Continued)

SAE	Society of Automotive Engineers
SB	Song-Beverly (Consumer Warranty Act)
SB	AB Svensk Bilprovning
SIP	State Implementation Plan
TÜA	Technisches Überwachungsamt
TÜV	Technischer Überwachungsverein
TBA	Tires - Batteries - Accessories
TSC	Transportation Systems Center
USASI	United States of America Standards Institute
VdTÜV	Vereinigung der Technischen Überwachungsvererine
VIU	Vehicle-In-Use
Voc-Ed	Vocational Education

1. SUMMARY

1.1 BACKGROUND

The automobile transportation system in the United States constitutes an investment on the order of 350 billion dollars.* Its annual maintenance and repair costs are on the order of 65 billion dollars.**

As the number of more fuel-efficient vehicles in the fleet is increasing there has been, and will continue to be, a corresponding increase in consumer and industry difficulties associated with auto inspection/maintenance/repair. The following industry and consumer needs may be identified:

- To transfer to the auto service community new technology associated with computerized electronic engine control systems developed by individual vehicle manufacturers,
- To transfer to the auto service community new technology associated with automated/computerized service and diagnostic equipment developed by instrument/apparatus manufacturers,
- To acquire new skills in performing complex testing, diagnostic and servicing procedures based on the above new technologies,
- To make additional capital investments in new facilities, tooling and equipment in order to service the fleet of fuel-efficient vehicles,
- To expand the size of the labor force, and to provide the thorough training needed to satisfy the demand for competent and professionally dedicated automotive mechanics/technicians,

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* Market value of motor vehicles under 10,000 lb. GVWR
** Source: Reference 1

- To reduce the level of consumer confusion, inconvenience, and the high cost of life-cycle costs, associated with owning, operating and servicing a fuel-efficient vehicle.

In the last fifteen years, the Federal and State Governments have become increasingly involved in the automotive transportation system through legislation regarding fuel conservation, air pollution, highway safety, and consumer protection.

This legislation affects the maintenance and repair industry in a number of ways. For example, to satisfy tight emission standards, the manufacturers produce computer controlled fuel injection systems. Proper maintenance of these systems may require special training, test equipment, and tools which some sectors of the repair and maintenance industry may not be able to afford. The result may be unnecessary fuel consumption and violation of the emission standards. Since violation of standards may be detected by inspections, those organizations that perform inspection are included, and the whole industry is referred to as the I/M/R (inspection, maintenance, and repair) industry.

1.2 PURPOSE AND SCOPE

Against this background, the following issues define the specific purpose of the study:

- What is the present status of the I/M/R industry?
- How is it structured and how are its component members interrelated?
- Does the I/M/R industry have the capacity, expertise, and financial strength to perform its function in a cost-effective manner?

- What is the impact of technological changes and increased regulation upon the I/M/R industry?
- Are there significant differences between American and foreign I/M/R service industries? If so, could an understanding of these differences benefit the U. S. I/M/R industry?

The scope of the study was to cover the I/M/R industry's effect on consumer-owned motor vehicles under 10,000 lb GVWR, with heavy emphasis on passenger cars. Thus, fleet operations and trucks have been excluded from this study.

Because of constraints imposed by a low contract budget, its limited time duration, and legal considerations (as explained below), the gathering and analysis of consumer inputs related to the I/M/R industry has also been beyond the scope of this study.

1.3 APPROACH

The economic, societal, and political importance of the I/M/R industry has given rise to many studies which address these questions. In order to offer additional perspectives, the main thrust of the project was to assess the industry from within, and to provide a basis for further in-depth studies. In this respect, and in view of the available resources for and the methodological restrictions on the study, it was determined that direct contact with key domestic and foreign officials affiliated with the manufacturers, I/M/R trade associations, educational and training organizations, State and Federal Government agencies, and many others, would be more effective than analysis of the data contained in published reports. Many of these organizations also assembled extensive supplementary data in support of this study.

Much of the information obtained from various organizations was based on the results of surveys of their own. Information gathering through surveys by the project team has been employed to a very limited extent only, because the use of such techniques is severely limited by regulations of the Office of Management and Budget. This was one of the reasons why consumer surveys could not be conducted.

The findings (Section 1.4) and suggested actions (Section 1.5) are based partly on these sources of data, on facts and thoughts, and partly on the specialized automotive service industry expertise of key members of the project team.

1.4 FINDINGS

1.4.1 Industry Structure

The I/M/R industry is comprised of many entities with varying objectives, capacities, and capabilities. The industry's complexity is generally misunderstood and underestimated. For clarification purposes, two major industry categories were defined and analyzed:

- the "Trade Group," whose members perform maintenance and repair work
- the "Support Group," whose members supply and support the trade group

Within the support group, auto manufacturers play the most important role. Maintenance requirements and repairability of their products have far reaching effects. Parts and equipment manufacturers, training institutes, literature producing companies -- all depend on specific assistance from the auto manufacturers.

Within the trade group, new vehicle dealers perform a larger portion of service related business than generally assumed. In terms of both actual and relative service network contribution, new vehicle dealers lead, followed in turn by auto-home-TBA-stores, service stations, and others.

1.4.2 Data Availability

The data base for the I/M/R industry is incomplete, and often conflicting or overlapping. Industry officials unanimously noted that published data represent, in most cases, knowledgeable estimates at best. An evaluation of the trade group members' performance is severely hampered by the absence of agreed upon standards. Information regarding cost of vehicle operation is usually based on limited fleet owner experiences or isolated studies which use numerous assumptions. An objective assessment of the volume and type of customer complaints is not possible due to the lack of uniform criteria.

1.4.3 Industry Problems

Justified consumer complaints about reliability and cost of automobile service are the result of these basic problems within, but not limited to, the I/M/R industry:

- a general decline in productivity and pride of workmanship
- the absence of specific operating standards for all trade group members and the absence of corresponding performance evaluations
- the absence of support by private, public and government institutions for trade apprentice programs, technical training schools, and continuing technical education, and of consistently applied professional standards for such training programs.

Current debates center around financial hardships for small, independent garages and means to protect their very existence in the marketplace. Considering the consumer's disenchantment with the I/M/R industry's performance, the fact must be recognized that the complexity of automobiles is simply increasing at a faster pace than is the ability of some industry segments to cope with these technological changes.

1.4.4 Consumer Protection

Improved means of consumer protection are presently being implemented by industry and private groups, and by state and local governments through legislation and regulation. Sufficient protection appears to be available to the consumer in many jurisdictions and communities, provided he makes some effort to learn his legal rights and available remedies, and becomes aware of alternative methods of obtaining satisfactory service. The consumer must also be willing to incur various costs associated with his protection, such as the performance of vehicle diagnosis by a third party.

1.4.5 Warranty

The performance of repairs covered under warranty has greatly improved during the last two years. New vehicle dealers are generally satisfied with reimbursement and administrative procedures. If current attempts to obtain full warranty coverage from auto manufacturers are successful, the benefits to consumers are questionable, because of related vehicle price increases. Since independent workshops would be at a competitive disadvantage, pressures to permit the performance of warranty repairs by independent garages will increase. Adherence to various Federal, State, and local regulations after the warranty has expired is questionable. While current warranty legislation forces the automobile manufacturers and dealer networks to back-up purchases of their products with warranty and properly followed maintenance procedures, similar safeguards do not exist after warranty expiration.

1.4.6 Parts Supply

The automotive parts aftermarket is a complex, highly interwoven network.

All levels involved in the manufacturing and distribution of parts have a vital support function: namely, to supply the right part at the right time. Among many members of the trade group, so-called "parts inventory management" is often non-existent or not fully utilized. The unavailability of parts is the primary reason for delays in vehicle repair completion, a major irritation to the consumer. In addition it has an adverse effect on the productivity of trade group members.

Another important aspect of the automotive aftermarket parts business is its impact on the adherence to safety and emissions regulations. Aside from the correct performance of the labor operation, the use of appropriate parts determines whether or not the vehicle will meet the manufacturers' specifications.

Various parts sold in the aftermarket must be in compliance with the Federal Motor Vehicle Safety Standards, of which there are fifty-one. Enforcement through NHTSA's Office of Motor Vehicle Safety Compliance (DOT) consists of surveillance testing of vehicle components during manufacture, and buying and testing vehicles in use from the marketplace. Most recently, the Environmental Protection Agency (EPA) has proposed regulations which would recognize this same type of self certification program for aftermarket parts related to emission control.

1.4.7 Training

Public vocational education institutions perform the greatest amount of I/M/R training, but their results, with few exceptions, are unsatisfactory in terms of providing qualified entries for the auto mechanics trade. Secondary (high school) vocational automotive maintenance and repair training, in particular, must be considered a failure.

Private trade and technical schools and some post-secondary vocational education programs provide the strongest entries into the trade, but their numbers are relatively small, and their quality very uneven.

The automobile manufacturers offer the most advanced and up-to-date training. The majority of this training is directed towards skill improvement. The manufacturers are devoting considerable resources to the training of mechanics not affiliated with new car dealerships, and are generally very cooperative in supplying repair information to other trade and support group members.

Apprenticeship programs are the only realistic, long term means of providing highly qualified mechanics. At this time, however, enrollment in apprentice programs is practically non-existent, despite recent recruitment campaigns by industry associations. The major obstacle is I/M/R employers' resistance to long term training commitments.

Licensing of mechanics cannot improve the quality of auto maintenance and repair unless combined with a very strong national training effort.

1.4.8 Inspection Programs

Most states are far behind in their implementation of vehicle inspection programs, while political pressures on the state level have watered down existing PMVI and IM programs. As a result, no effective control of the motorist's adherence to Federal regulations exists. Tampering with automobile emission systems and using vehicle safety-impairing components are widespread, yet remain largely unchallenged. The absence of an effective national inspection program also deprives all parties concerned of comparative vehicle and service industry performance data.

1.4.9 Attitudes

At present, there exists a general atmosphere of distrust among consumers, the I/M/R industry, and involved government agencies. Accusations have activated defense mechanisms within the industry. Automobile manufacturers and other parent companies are wary of releasing service-related information. Their argument is that still existing service shortcomings are emphasized out of proportion by consumer groups and government agencies, while the same groups tend to discount the industry's accomplishments and ongoing efforts to improve service.

1.4.10 Foreign I/M/R Industry

Some answers to current U. S. I/M/R industry problems may have been found in Europe. The most noted difference appears to be the general attitude towards service. For many years, the corporate policy of most auto manufacturers has been "Service must be as good as the product". Leading German manufacturers, for example, place considerable emphasis on the reduction of overall vehicle maintenance and repair need, the simplification of vehicle diagnosis, the reduction of time required for the performance of high frequency labor operations, and the general lowering of repair complexity levels. For these manufacturers, service-related product improvements are an important part of their design and marketing strategies.

An analysis of the West German I/M/R industry, which is symptomatic for other European countries, showed the application of various repair techniques and organizational approaches not usually found in the United States. The general emphasis is on specialization and automation. Current trends point towards exchanging vehicle sub-assemblies in favor of repairing them. Major differences exist also in the body repair business. Europeans generally apply strict standards to body shop operations. The competence level of body repair mechanics, the high degree of equipment application, and functional design and cleanliness of facilities are some of the outstanding features.

1.4.11 Foreign Government Involvement

Governments in most West European countries have assumed supporting roles. In West Germany, for example, public resources are used to maintain and further develop the massive national apprentice program. Over the past decades, the country's I/M/R industry maintained a ratio of about one apprectice for every qualified technician employed. The vocational school system is financed through government funds. Current annual government expenditures for the ongoing training of approximately 93,000 automotive apprentices is estimated at $41.1 million.

Inseparable from activities within the I/M/R industries are Government vehicle inspection programs in Europe. Inspection of the vehicle, of its accessories, and of post-accident repairs is widespread and, in general, well received by the consumer. The emphasis is on safety, but increasing importance is given to emissions and noise. With some exceptions the inspections are performed by a non-government entity which is financially disinterested in its findings, but is well intergrated organizationally into the I/M/R industry.

The following key features distinguish the foreign inspection systems from the proposed system in the United States:

- they are uniform within one country and are becoming more similar over time throughout Western Europe
- the organizations responsibile for inspection publish their results by make and model in a manner that effectively forces the manufacturers to improve their products
- inspection data and other vehicle related information acquired during inspections are fed to the vehicle data base that is maintained nationally and is used by various agencies, including law enforcement
- the inspection is functional and not diagnostic; that is, the ability of a subsystem to operate in accordance with manufacturer's standards is verified, but the required repairs are determined by the I/M/R industry.

1.4.12 Technological Changes

Based on interviews with European and U. S. automobile manufacturers, the most important technological changes foreseen for future automobiles are:

- incorporation of diesel engines
- downsizing and weight reduction
- application of electronic control systems.

The condensed opinion of service experts is that the U.S. I/M/R industry will be able to cope with these changes, but that economic pressures will bring a reduction in the number of service outlets, such as small independent garages and gas service stations. A clear trend is seen towards further specialization in the industry. Major improvements will be required in the body repair sector in order to offset rapidly increasing costs of accident repairs.

1.4.13 Insurance

The trend of basing insurance rates on vehicle repair costs is well established in Europe. Automobile manufacturers have made considerable progress in simplifying body repair methods. These improvements are particularily noticeable in Germany, to a large degree the result of basic research performed by the country's leading vehicle insurance company, Allianz Versicherungs Aktiengesellschaft. Its center for accident research, which today works closely with all automobile manufacturers, is credited with numerous cost saving recommendations. Similar research is performed in England by the Motor Insurance Repair Research Centre in Thatcham, Berkshire and in Sweden by the Folksam Insurance Company.

At present, only one insurance company is attempting to influence repairability through vehicle design in the United States. The trend in the United States, though, appears to be moving in this direction.

1.5 CONCLUSIONS

The I/M/R industry has identified the areas in need of improvements. No individual group, however, will be able to solve existing problems alone. The successful implementation and application of recommendations outlined in the paragraphs below would seem to hinge on the acceptance of the following principal parameters:

- Every level of management - wholesale and retail - must make a commitment to the consumer's ultimate satisfaction with both products and services.
- Cooperation is required between government agencies, the trade channels, and the motorist. Each must have a clear understanding and acceptance of its own and the others' functions and responsibilities.
- Elimination of overlapping and duplicated efforts (e.g. in areas such as repair technologies, equipment development, information systems, training, computer application) is required in order to increase the overall productivity and efficiency of the I/M/R industry.
- Improvements should be brought about through motivation wherever possible, rather than through reliance on regulation.

The fundamental interests of the groups involved must be safeguarded. Specifically:

- Consumers should receive quality products, backed by professional, personalized, convenient, and economical service.
- Both the trade and support groups should be able to realize a fair return on their investment and have the freedom to compete.

The following actions may be suggested for the I/M/R support group:

- Minimize the need for maintenance and repair of new automobiles.

- Advance diagnostic, maintenance, and repair technology, including the development of concepts for cost effective component exchange programs.
- Establish, support, and enforce comprehensive operating standards for mechanical and body repair operations.
- Develop, implement, and maintain a strong national apprentice training program in line with current and future technological and manpower requirements.
- Establish and maintain a managerial, organizational, and technical information system.
- Improve and expand complaint handling and arbitration programs.

The following actions may be suggested for the I/M/R trade group:

- Provide service which meets the expectations of owners and users of motor vehicles in regard to quality of workmanship, proper treatment of customers and interest shown by service personnel, convenience and availability, clarity and justification of charges.
- Provide and maintain services to the owners and users of motor vehicles in accordance with parent company's or association's operating standards.
- Support apprentice training programs.

The following actions may be suggested for the vehicle owner and user:

- Maintain and operate vehicle in accordance with the manufacturer's operating instructions, comply with recall requests, adhere to legally required periodic motor vehicle inspection schedule.

The Federal Government should act as a catalyst and coordinator in the following areas:

- National automotive apprentice programs
- Improvement in quality of public I/M/R vocational education
- Technical advancement of automotive diagnostic, maintenance and repair methods
- Consumer information.

Government should also continue to promote the establishment of a uniform national inspection program for periodic function testing of vehicles. Rather than propose novel and advanced inspection systems and standards, the general type of uniform and cost-effective inspection system that has been well accepted abroad should be considered, including the related publication of inspection results and establishment of a national vehicle data base. The existing I/M/R trade group should be "integrated" into this inspection system, an approach successfully used in West Germany. The objective of this inspection system should be to support the long term interests of the consumer, and it should therefore be isolated from local and short term considerations.

Probably the most effective means to implement the required changes is public evaluation of the I/M/R industry's performance. Congress has recognized the importance of automotive consumer information and has passed appropriate legislation (Motor Vehicle Information and Cost Savings Act of 1972). In line with this Act the following means would measure and reward progress:

- Publication of failure rates by make and model. The base data is to be obtained during mandatory periodic motor vehicle inspections.

- Publication of average annual estimated maintenance and repair requirements (excluding accident repairs) by make and model expressed in labor hours per a specific number of miles and in costs of related parts.
- Evaluation of the services offered by all trade group members, with ratings published and displayed.

Some segments of the I/M/R industry will be strongly opposed to such ratings and publications. However, there will be equally strong support from those who are meeting the consumers' expectations. The marketplace will benefit from healthy competition. There is no doubt that progress made in the area of automotive maintenance and repair will become a persuasive marketing force.

2. INTRODUCTION

The Automobile Transportation System is presently undergoing profound changes as a direct result of increasing cost and shortage of fossil fuels and the need to protect general resources, the environment, public health and safety. Related legislation has indirectly changed and will continue to change automobile design drastically.

The Inspection/Maintenance/Repair Industry assumes a major role in the Automobile Transportation System. Aside from this industry's economic significance, it must also safeguard the considerable efforts vested in the design and production of fuel efficient, safe and pollution-free automobiles, while at the same time keeping the automobile expenses of the consumer at reasonable levels. As generally recognized, this represents a major logistical, technical, and financial challenge to concerned segments of industry and government.

This study describes the current status of the Inspection/Maintenance/Repair Industry in the United States, the impact of technological changes and legislation, and related approaches used in Germany and Sweden.

3. ANALYSIS OF THE CURRENT STATUS OF THE INSPECTION/MAINTENANCE/REPAIR INDUSTRY

3.1 COMPOSITION AND MAGNITUDE OF THE INDUSTRY

The motor vehicle industry represents a large and vital part of the United States economy.

According to the Motor Vehicle Manufacturers Association:[1]

- At the end of 1978, the motor vehicle industry and related industries employed approximately fourteen million people, or about 20 percent of the country's total labor force. One fifth of these, an estimated 2.8 million people, were engaged in selling and servicing automobiles.
- During 1978, 117 million passenger cars, 505 thousand buses, and 31 million trucks were registered for operation.
- In 1977* motor vehicles provided more than 90 percent of all personal travel; in 1978 trucks accounted for nearly 25 percent of all intercity freight traffic.

This important segment of the total economic system has a large impact on:

- Energy (required to produce, operate, maintain, and recycle vehicles)
- Environment (air, water, visual, and noise pollution)
- Health (injuries, illness)
- Overall management of available resources.

Today, we witness a growing concern that maintenance and repair of vehicles in operation must receive more attention. Two main reasons are usually cited:

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* The last year this was surveyed by MVMA

- It does not make sense to build fuel-efficient, safe and emission-controlled cars without ensuring that these vehicles are operated and maintained within manufacturers' minimum design standards.

- There is an increasing consumer awareness: a change from a passive buyer and user to an active force in the market place, with specific demands as to products and service.

The number and variety of groups involved in maintaining and repairing the United States Automobile Transportation System are considerable.

These groups constitute the so-called maintenance and repair industry, which is expected to conduct a sixty-five billion dollar business in 1979.[1]

3.1.1 Identification, Definition and Primary Objectives of the I/M/R Trade Channels

The inspection/maintenance/repair industry is comprised of various trade channels which fall into two categories:

- Business entities performing maintenance and repair work, hereafter referred to as I/M/R Trade Group.

- Business entities supplying and supporting the trade group, hereafter referred to as I/M/R Support Group.

Tables 3-1 and 3-2 provide definitions and objectives of individual members of the Trade Group and Support Group respectively.

With the exception of certain training institutions and associations, members of both groups are primarily motivated by profits derived from the sale of products and services. In the I/M/R Trade Group, some derive their income solely from the sales of service and parts, while others (e.g., new car dealers, service stations) have additional sources of income.

New car dealers, general garages and service stations have been involved in the maintenance and repair of vehicles since the automobile's inception, while mass merchandisers and franchised specialty repair shops began their forceful market penetration after World War II. By definition, the do-it-yourself segment is not considered a trade channel and was therefore excluded from the following tables.

3.1.2 Principal Activities of the I/M/R Trade Channels

I/M/R Trade Group

The ever-growing vehicle population and product diversification has led to segmentation of the I/M/R market.

Traditionally, new vehicles delivery inspection, warranty-related repairs, and, as of late, recall campaigns are performed by new car dealers.

Internal and warranty labor sales are estimated to account for 25 percent of an average dealer's total labor sales, with the remaining 75 percent falling into the customer labor sales category. New car dealers usually maintain strong ties to customers during the first two years of vehicle ownership. As the car is traded and increases in age, general workshops, repair specialists, and mass merchandisers collectively begin to account for major market shares. Evolving in the post-warranty period are two groups: one performing high-volume, high-profit operations (repair specialists, mass merchandisers), while the second performs a mixture of labor operations based on individual preferences (general workshops).

With the arrival of lengthened warranty periods and service contracts, independent groups are seeking authorization from the manufacturers to perform warranty related work. Such a development would require the application of manufacturers' operating standards to independent groups performing warranty related work.

The principal activities of the I/M/R Trade Group are listed in Table 3-3.

TABLE 3-1. IDENTIFICATION, DEFINITION AND PRIMARY OBJECTIVES OF THE I/M/R TRADE GROUP

IDENTIFICATION	DEFINITION	OBJECTIVES
New Vehicle Dealers	Franchised operations, generally owned and operated by private individuals. Some automobile manufactures maintain so-called factory outlets in selected metropolitan markets	Sales of new and used cars, service and parts
Independent General Garages	Non-franchised, individually owned and operated firms	Sales of service and parts
Independent Specialty Repair Shops	Non-franchised, individually owned and operated firms	Sales of selected services and parts
Franchised Specialty Repair Shops	Franchised, individually or company owned and operated firms	Sales of selected services and parts
Gas Service Stations	Franchised, individually or company owned and operated firms , or independent retailers	Sales of gasoline and oil, selected services and parts
Mass Merchandisers	Company owned and operated firms	Sales of selected high volume services and parts
Auto and Home Supply Stores, TBA Stores	Individually or company owned and operated firms, some franchised	Sales of parts and selected services
Fleet Owner Garages	Operated by fleet owners	Service back-up for fleet in operation

TABLE 3-2. IDENTIFICATION, DEFINITION AND PRIMARY OBJECTIVES OF THE I/M/R SUPPORT GROUP

IDENTIFICATION	DEFINITION	OBJECTIVES
Auto Manufacturers	Domestic or foreign manufacturers of automobiles and parts	Sales of vehicles and parts
Parts Manufacturers	Domestic or foreign manufacturers of parts	Sales of parts
Oil Companies	Domestic or foreign processor of oil	Sales of petroleum products
Tire Manufacturers	Domestic or foreign manufacturer of tires and selected parts	Sales of tires and related rubber products
Parts Distributors	Manufacturer or individually owned and operated establishment for storage and distribution of parts	Sales of parts
Oil and Gasoline Distributors	Oil company or individually owned and operated firms for storage and distribution of petroleum based products	Sales of petroleum based products
Equipment Manufacturers	Domestic or foreign manufacturers of tools and equipment	Sales of tools and equipment
Equipment Distributors	Manufacturer or individually owned and operated firms for storage and distribution of tools and equipment	Sales of tools and equipment

TABLE 3-2. IDENTIFICATION, DEFINITION AND PRIMARY OBJECTIVES OF THE I/M/R SUPPORT GROUP (CONT.)

IDENTIFICATION	DEFINITION	OBJECTIVES
Publishing and Printing Companies	Individually owned and operated firms	Sales of literature and forms
Computer Companies	Domestic or foreign manufactures of computers. Domestic or foreign firms for systems development and services	Sales of computer hard- and software
Vocational Schools and Special Colleges	Educational institutions	Training on a profit or non-profit basis
Associations	Domestic or foreign interest groups	Protection of memberts' interests, strengthening of competitiveness

TABLE 3-3. PRINCIPAL ACTIVITIES OF THE I/M/R TRADE GROUP

Members	Activities
New Vehicle Dealers	Perform labor operations as specified by auto manufacturer. Perform customer, internal, warranty, recall campaign related transactions.
Independent General Garages	Perform labor operations according to technical and financial capabilities. Perform services for general public.
Independent and Franchised Specialty Repair Shops	Perform selected, high volume labor operations. Perform services for the general public (exhaust systems, transmissions, tune-ups, electrical, etc.).
Gas Service Stations	Sell gasoline and oil, perform selected labor operations. Perform services for the general public.
Mass Merchandisers, Home & Auto Supply Stores, TBA Stores	Sell parts and accessories, perform selected high volume labor operations. Perform services for the general public (Sears, Montgomery-Ward, Reg. Chains, Tire)
Fleet Owners	Perform labor operations, according to technical and financial capabilities. Perform services for own fleet only (Rent-A-Car Co.s, Taxi Co.s, etc.).

I/M/R Support Group

The maintenance and repair of automobiles requires substantial logistical and technical support. The availability of parts in the right quantity at the right time or the distribution of product-related technical information are just two examples selected from a multitude of activities. The principal activities of the I/M/R Support Group are listed in Table 3-4.

TABLE 3-4. PRINCIPAL ACTIVITIES OF THE I/M/R SUPPORT GROUP

Members	Activities
Auto Manufacturers	Research, development, manufacturing, and distribution of vehicles and parts. Development and distribution of tools, equipment, literature, and training aids. Development of maintenance and repair methods. Training of service personnel. Administration of warranty, consumer complaints, recall campaigns. Field technical support. Marketing support.
Parts Manufacturers	Research, development, manufacturing, and distribution of vehicles components and parts. Administration of warranty recall campaigns. Field technical support. Marketing support.
Oil Companies	Production and distribution of gas, oil, lubricants, and related research and development. Development of maintenance methods. Training of service personnel. Administration of warranty and consumer complaints. Field technical support. Marketing support.
Tire Manufacturers	Research, development, manufacturing, and distribution of tires and related products. Development of repair methods. Administration of warranty, consumer complaints, recall campaigns. Field technical support. Marketing support.
Equipment Manufacturers	Research, development, manufacturing, and distribution of service equipment and tools. Development of repair methods. Development and distribution of technical literature. Training of service personnel. Field technical support. Marketing support.

TABLE 3-4. PRINCIPAL ACTIVITIES OF THE I/M/R SUPPORT GROUP (CONT.)

Members	Activities
Parts Distributors	Distribution of parts. Administration of warranty programs. Training of service personnel. Field and marketing support.
Petroleum Products Distributors	Distribution of petroleum products. Administration of warranty programs. Field and marketing support.
Equipment Distributors	Distribution of service equipment. Training of service personnel. Field and marketing support.
Publishing and Printing Companies	Development, production, and distribution of literature, forms, and training aids.
Computer Companies	Systems research and development. Research, development, manufacturing, and distribution of computers. Training of equipment users. Field support.
Vocational Schools, Colleges	Development and production of training material. Training of service personnel.
Associations	Protection of members' interests. Managerial, organizational, legal, and technical support. Purchasing cooperatives.

3.1.3 Interaction Among the I/M/R Trade Channels

The complexity of the I/M/R industry is best demonstrated by examining the type and volume of business transactions conducted between the I/M/R Support Group and the I/M/R Trade Group.

In addition, considerable interdependence exists among the members of each group. In the supply/support group, automobile manufacturers play the most important role.

Vehicle design specifications permit oil companies and manufacturers of parts, tires and service equipment to develop their respective lines of products.

These products, in turn, find their way into various distribution channels.

Parallel to these activities, the development and production of service-related support programs requires close cooperation among the various companies. Typical examples are: maintenance and repair methods, repair time studies, special tools and equipment, training programs, and technical literature.

A continuous flow of technical, administrative, and systems-related information between the Support and Trade Groups is maintained at all times.

Within the I/M/R Trade Group, sales of parts, exchange of information, and performance of so-called sublet work are symptomatic and typical.

Strong traditional ties exist between manufacturers of products and their franchised outlets (dealers, service stations, franchised repair specialists). However, all manufacturers provide considerable support functions to the non-franchised members of the I/M/R Trade Group, including the do-it-yourself segment.

While most associations of independent trade groups have developed by-laws and business codes for their members, adherence to these guidelines is voluntary. This is in contrast to the franchised trade groups, which are governed and guided by specific operating standards as a condition of their franchise agreements.

Interaction among the members of the Trade and Support Groups is constant. In order to identify major interrelationships, only principal activities of the I/M/R Support Group, and interaction among members of the Support and Trade Groups are reported in Table 3-5.1 through 3-5.5.

Circles indicate principal activities of support group members A-L

F Capital letter in circle identifies support group members with whom close cooperation is maintained

5 Number in circle identifies specific member of trade group receiving direct support.

Examples in the use of these Tables follow:

Table 3-5.1

Example B C D E first line, first column:

In the area of vehicle R & D, Auto Manufacturers work closely with Parts Manufacturers (B), Oil Companies (C), Tire Manufacturers (D), and Equipment Manufacturers (E).

Table 3-5.2

Example A I K, sixth line, twelfth column:

Trade Associations recommend, distribute, and/or produce technical literature and training aids. In this endeavor, they work closely with Auto Manufacturers (A), Publishing and Printing Companies (I), and Vocational Schools and Colleges (K).

Table 3-5.3

Example G K L 5 , sixth line, third column:

Oil Companies maintain inventories of literature and training aids for Petroleum Products Distributors (G), Vocational Schools, Colleges (K), Trade Associations (L), and Gas Service Stations (5).

Table 3-5.4

Example A F , first line, fourth column:

Tire Manufacturers maintain Field Product Quality Controls in cooperation with Auto Manufacturers (A) and Parts (Tire) Distributors (F).

Table 3-5.5

Example 1-8 , line two, column ten:

Computer Companies install computers, develop specific software, and provide operational assistance for trade group members 1 through 8 (New Vehicle Dealers (1), General Garages (2), Independent Repair Specialists (3), Franchised Repair Specialists (4), Gas Service Stations (5), Mass Merchandisers(6), Auto Supply Stores (7), Fleet Owner Garages (8)).

TABLE 3-5.1. PRINCIPAL ACTIVITIES OF THE I/M/R SUPPORT GROUP AND INTERACTION AMONG MEMBERS OF THE SUPPORT GROUP

	SUPPORT GROUP / PRINCIPAL ACTIVITIES	A Auto Manufacturers	B Parts Manufacturers	C Oil Companies	D Tire Manufacturers	E Equipment Manufact.	F Parts Distributors	G Petroleum Prod. Distr.	H Equipment Distributors	I Publishing/Printing Co.	J Computer Companies	K Voc. Schools, Colleges	L Associations
RESEARCH AND DEVELOPMENT	VEHICLES	B C D E											
	COMPONENTS, PARTS, ACCESSOR.	B D	A										
	TIRES				A								
	GAS, OIL, LUBRICANTS			A									
	SERV. EQUIPMENT, TOOLS	C E		E	E	A C D							
	MAINTENANCE & REPAIR METHODS	C E		A	A E	A C D							
	INFORMATION SYSTEMS	I J		I J						A	A	A L	E

TABLE 3-5.2. PRINCIPAL ACTIVITIES OF THE I/M/R SUPPORT GROUP AND INTERACTION AMONG MEMBERS OF THE SUPPORT GROUP

	PRINCIPAL ACTIVITIES / SUPPORT GROUP	Auto Manufacturers A	Parts Manufacturers B	Oil Companies C	Tire Manufacturers D	Equipment Manufact. E	Parts Distributors F	Petroleum Prod. Distr. G	Equipment Distributors H	Publishing/Printing Co. I	Computer Companies J	Voc. Schools, Colleges K	Associations L
MANUFACTURING	VEHICLES	B C D											
	COMPONENTS, PARTS, ACCESSOR.	B	A										
	TIRES				A								
	GAS, OIL, LUBRICANTS			A									
	SERV. EQUIPMENT, TOOLS	E				A C D							
	LITERATURE, TRAINING AIDS	I	I	I	I	I				A B C D E	A	A I	A I K
	COMPUTERS												

TABLE 3-5.3. PRINCIPAL ACTIVITIES OF THE I/M/R GROUP AND INTERACTION AMONG MEMBERS OF THE SUPPORT AND TRADE GROUPS

PRINCIPAL ACTIVITIES \ SUPPORT GROUP		A Auto Manufacturers	B Parts Manufacturers	C Oil Companies	D Tire Manufacturers	E Equipment Manufact.	F Parts Distributors	G Petroleum Prod. Distr.	H Equipment Distributors	I Publishing/Printing Co.	J Computer Companies	K Voc. Schools, Colleges	L Associations
WAREHOUSING, DISTRIBUTION	VEHICLES	1											
	COMPONENTS, PARTS, ACCESSOR.	F 1 6 7	A F				1-9						
	TIRES				A F		1-9						
	GAS, OIL, LUBRICANTS			A F G				1-9					
	SERV. EQUIPMENT, TOOLS	H K 1				A C D H			1-9				
	LITERATURE, TRAINING AIDS	K L 1-9	F L 4 6 7	G K L 5	F K L 4 6 7	A C D H K L	1-9		1-9	A C D E K L	A L 1 4 6 7	1-8	1-8
	COMPUTERS										A 1 4 6 7		

Numbers in matrix refer to these specific members of the trade group:

1 = New Vehicle Dealers
2 = General Garages
3 = Indep. Repair Specialists
4 = Franchised Repair Specialists
5 = Service Stations
6 = Mass Merchandisers
7 = Auto Supply Stores
8 = Fleet Owner Garages
9 = Do-It-Yourself Segment

TABLE 3-5.4. PRINCIPAL ACTIVITIES OF THE I/M/R GROUP AND INTERACTION AMONG MEMBERS OF THE SUPPORT AND TRADE GROUPS

PRINCIPAL ACTIVITIES \ SUPPORT GROUP		A Auto Manufacturers	B Parts Manufacturers	C Oil Companies	D Tire Manufacturers	E Equipment Manufact.	F Parts Distributors	G Petroleum Prod. Distr.	H Equipment Distributors	I Publishing/Printing Co.	J Computer Companies	K Voc. Schools, Colleges	L Associations
ADMINISTRATIVE SUPPORT	FIELD PRODUCT QUALITY CONTR.	1 8	A F	A G 5 8	A F								
	WARRANTY PROGRAMS	1 8	A F	A G 5 8	A F		1-8	1-8					
	RECALL CAMPAIGNS	1 8	A F		A F								
	CONSUMER RELATIONS/INFORMAT.	L 1 8		A G L 5 8	A F L								1-8
TRAINING	MANAGERIAL	1		5	4 6						A 1-8	1-8	1-8
	ORGANIZATIONAL/OPERATIONAL	1		5	4 6						A 1-8	1-8	1-8
	TECHNICAL	1-9	A	1-9	A 4 6	H 1-8			1-8			1-9	2 3 5

Numbers in matrix refer to these specific members of the trade group:

1 = New Vehicle Dealers
2 = General Garages
3 = Indep. Repair Specialists
4 = Franchised Repair Specialists
5 = Service Stations
6 = Mass Merchandisers
7 = Auto Supply Stores
8 = Fleet Owner Garages
9 = Do-It-Yourself Segment

TABLE 3-5.5. PRINCIPAL ACTIVITIES OF THE I/M/R GROUP AND INTERACTION AMONG MEMBERS OF THE SUPPORT AND TRADE GROUPS

PRINCIPAL ACTIVITIES \ SUPPORT GROUP		Auto Manufacturers A	Parts Manufacturers B	Oil Companies C	Tire Manufacturers D	Equipment Manufact. E	Parts Distributors F	Petroleum Prod. Distr. G	Equipment Distributors H	Publishing/Printing Co. I	Computer Companies J	Voc. Schools, Colleges K	Associations L
FIELD SUPPORT	TECHNICAL	1 8	F	A 5 8	A F 4 6 7 8	A H		1-8	1-8				2 3
	OPERATIONAL	1		5	F 4 6 7						1-8		2 3
	FACILITY PLANNING	1		5		1-8							
	BUSINESS MANAGEMENT	1		5	F 4 6 7						1-8		1-8
MARKETING SUPPORT	MARKET RESEARCH	1	F	5	F 4 6 7		1-7						2 3
	PROMOTION	1	F	5	F 4 6 7	1 4 6	1-7	1-7					2 3
	ADVERTISING	1	F	5	F 4 6 7	1 4 6	1-7						2 3

Numbers in matrix refer to these specific members of the trade group:

1 = New Vehicle Dealers
2 = General Garages
3 = Indep. Repair Specialists
4 = Franchised Repair Specialists
5 = Service Stations
6 = Mass Merchandisers
7 = Auto Supply Stores
8 = Fleet Owner Garages
9 = Do-It-Yourself Segment

3.1.4 I/M/R Trade Group Vital Statistics

Table 3-6 reports the number of outlets, and the total and average workstall count, technician count, revenues, and capital investment of the I/M/R trade groups.

The key difficulty facing the researcher compiling these statistics is not necessarily a lack of data, but rather an abundance of often conflicting and/or overlapping data. The situation is further complicated by a lack of generally accepted definitions of the trade groups, and of consistent data breakdowns.

A wide variety of statistics is published by various industry associations and trade journals. The primary sources for these statistics are internal surveys and the 1972 Census of Business conducted by the United States Bureau of the Census. In reviewing these statistics, several problems were encountered, with the following being most significant:

- Major changes in numbers and market orientation have occurred among members of the trade group since the 1972 Census. Thus the primary data base must be viewed with some caution at this time.
- Industry surveys are, in general, hampered by overlapping memberships in trade associations and trade journal circulation, by defining members of the trade group in terms of the surveyor's particular interest, and by the lack of uniform, regular, centralized reporting programs.
- The split between retail parts sales not connected with actual maintenance and repair (sale to the do-it-yourself market and to members of the trade group), and parts sales occurring as a consequence of maintenance and repair is inadequately documented. This is particularly so in the case of general merchandisers:

TBA stores, auto and home supply stores, and other mass merchandisers. Thus, the market position of these industry segments is difficult to determine with any certainty.

- Wholesale parts and sublet labor sales among the members of the trade group almost certainly result in double reporting of these figures.

Industry officials who were interviewed regarding data accuracy and sources almost unanimously noted that available data may be interpreted in many ways, and that its reliability as a meaningful overall data base is questionable more often than not. One executive of a major oil company (who wishes to remain anonymous) noted that he had been trying to produce accurate data on service stations for over five years, and had not yet been able to report such data with any degree of confidence.

After a diligent search, within the scope limitations of this study, the authors have concluded that the available published data for 1978 represent, in most cases, knowledgeable estimates at best. With the exception of the figures for new vehicle dealers, the information in Table 3-6 should be viewed and used as such (see Table 3-1 for definitions of Trade Group members).

In view of the nation's current focus on the automotive transportation system, it is strongly recommended that the Department of Transportation and the Bureau of the Census undertake the joint design of a special census of the I/M/R industry, to be conducted by the Bureau of the Census in the near future. Considering the major decisions to be made regarding the I/M/R industry, legislative and regulatory activity must be founded on an up-to-date, accurate, nationwide data base.

TABLE 3-6. -1978 I/M/R TRADE GROUP NETWORK STATISTICS*

Trade Group Member	Number of Outlets	Number of Workstalls		Number of Technicians		Sales of Labor and Related Parts (in Million)		Service Related Capital Investment (in Million)	
		Total	Average	Total	Average	Total $	Average	Total $	Average
New Vehicle Dealers	28,850	577,000	20	235,000	8.2	16,416	0.569	14,425	0.500
Gas Service Stations	74,250	222,750	3	126,225	1.7	2,970	0.040	10,617	0.143
Independent General Garages	35,900	179,500	5	100,520	2.8	6,160	0.172	6,050	0.169
Specialty Repair Shops	40,750	163,00	4	130,400	3.2	7,540	0.185	7,200	0.177
Auto-Home-TBA Stores	65,200	195,600	3	182,560	2.8	3,260	0.050	10,692	0.164
Mass Merchandisers	3,500	50,000	14	35,000	10.0	1,175	0.335	1,225	0.350
Total	248,520	1,387,850	--	809,705	----	37,521	----	50,209	-----

*Sources of information are discussed below under "Accuracy of Data".

Some comments regarding Table 3-6:

- Number of Outlets. The figure for repair specialists includes body, paint, and top shops. The figure for mass merchandisers includes only the Penney's, Sears, Wards type of operation. Although many discount stores and chains offer some maintenance and repair services, the available data are not susceptible to accurate analysis.

- Technicians. Because the total employment count varies considerably among members of the trade group, depending on their particular market orientation, a technician count is believed to be more indicative of contribution to the I/M/R industry. The question of how many of those reported are actually qualified technicians is open. Our estimate is that a maximum 80 percent would be considered medium-skilled technicians or better. The majority of the lesser skilled "technicians" are concentrated in the service station and auto and home stores counts.

- Revenues. Only service labor sales and parts sales associated with service labor are reported. Total I/M/R industry revenues are considerably higher, since sales of \$13 to \$16 billion to the Do-It-Yourself market are not included, nor are tire sales of \$11 billion*.[1,3,7] Wholesale parts and sublet labor sales have been removed from new vehicle dealer sales to avoid double counting.

- Capital Investment. Only capital investment associated with the performance of maintenance and repair work has been reported. Total capital investment will be considerably higher for all trade group members except

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* See dicussion in Sections 3.4.2 and 3.4.3.

general garages and repair specialists, due to additional investment required for other products such as TBA and gasoline. This is especially true in the case of New Vehicle Dealers, where the investment noted represents only about 50 percent of the total investment.

- Accuracy of Data. Figures for new vehicle dealers, obtained from NADA and interviews with vehicle manufacturers, may be considered very accurate. The reservations noted previously apply to the remaining figures.

In addition to interviews with NADA and automobile manufacturers, Table 3-6 was compiled primarily from the seven following sources:

1. Reference 1
2. Reference 2
3. Reference 23
4. Evaluation of Diagnostic Analysis and Test Equipment for Small Automotive Repair Establishments - A Report to Congress, National Highway Traffic Safety Administration, U. S. Department of Transportation, DOT-HS-803536, July 1978
5. "1979 Market Data Book Issue", Automotive News, April 25, 1979
6. Franchising, January, 1978
7. Franchising in the Economy 1977 - 1979, Industry and Trade Administration, U. S. Department of Commerce, January 1979

As the figures given in the above sources differ considerably in some cases and/or are not always directly comparable, all data were examined and cross-checked to resolve differences and to enable comparisons. Where a range of figures resulted from the data analysis, the average figure was selected. Numbers of outlets were updated as necessary to 1978 levels using the growth rates noted in Reference 4 on the previous page. Sales and investment figures were updated as necessary to 1978 levels using the appropriate escalators from the Bureau of Labor Statistics Consumer Price Index.

When analyzing the trade group network statistics in Table 3-6, these points should be noted. Service Stations and Auto-Home-TBA Stores lead the trade group with 74,250 and 65,200 outlets respectively. While New Vehicle Dealers and Mass Merchandisers have fewer outlets than any other group member, both lead in all categories related to size and volume of business per outlet: average number of workstalls and technicians per outlet, sales of labor and related parts per outlet, and service related capital investment per outlet.

The relative strength of each trade group member is reflected in Figure 3-1. In terms of both actual and relative service network contribution, New Vehicle Dealers lead within the trade group, followed by Auto-Home-TBA Stores and Service Stations.

3.2 RELATIONSHIPS OF THE TRADE CHANNELS

Within the scope of this report, analysis of the relationships among the interest groups involved in the auto repair industry must by necessity be limited to an overview. Numerous reports have been published on the subject during recent years, and the objective reader will detect contradictory views and evaluations. This is understandable, considering the industry's economic significance and its impact on energy, environment, safety, and health.

The sectors of the United States political and economic structure directly involved in the auto repair industry are:

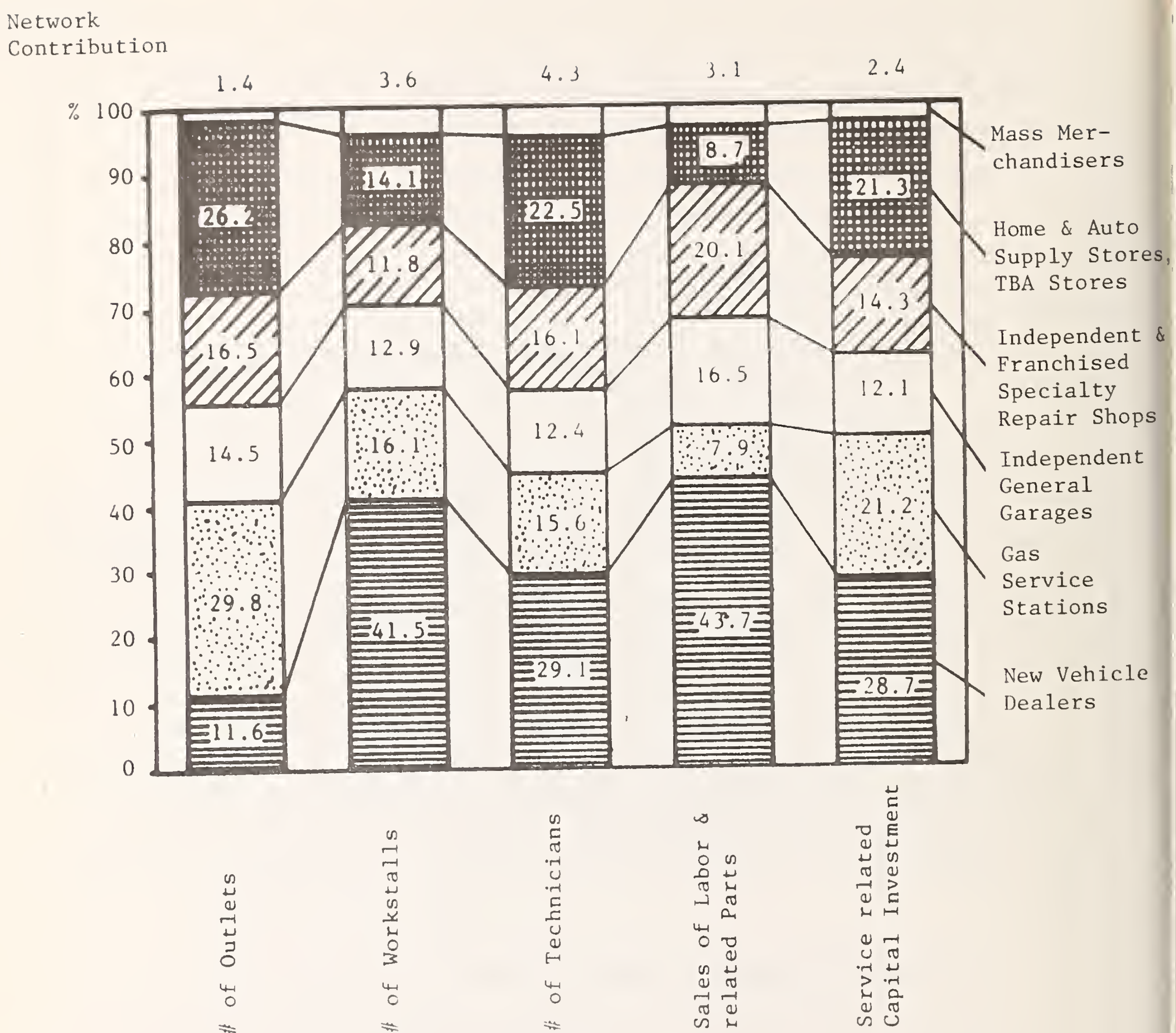


FIGURE 3-1. CONTRIBUTION OF I/M/R TRADE GROUP MEMBERS TO SERVICE NETWORK

- The trade channels, consisting of the trade and support groups as defined in the preceding sections of this report
- The consumer or, perhaps more accurately, the automobile owner and user
- The labor unions
- The Federal and State Governments.

Relationships within and among these sectors range from cooperation to confrontation:

- Within the trade group, new vehicle dealers, franchised and independent workshops, service stations, and mass merchandisers are competitors. This competition has not precluded cooperation: new vehicle dealers sell parts to independent workshops, repair specialists perform sublet repairs for other group members. In general, existing competition has benefited the consumer.
- Within the support group, a similar situation exists. Automobile manufacturers for example, work closely with parts manufacturers, to fill production needs while at the same time competing in the after sales market. In general, a spirit of cooperation prevails.
- The support and trade groups typically cooperate with each other. Automobile manufacturers, for example, provide independent workshops with technical assistance, training, and information. Very close ties exist, of course, between manufacturers or parent companies and their franchises, such as dealers or repair specialists. Some confrontation does occur, however, as in the cases of crash parts distribution and factory installation of accessories.
- Relations between both trade channels and the unions are typical of prevailing labor relations. Reduction in working

hours and increases in wages and fringe benefits have been major reasons for retail labor rate increases. In some parts of the country, union opposition or restrictive agreements have hampered apprentice programs, although some unions do actively promote these programs. From an employee's point of view, many service operations offer less-than-attractive working conditions. Unskilled assembly line workers in factories are often better paid than qualified auto technicians in the field. Numerous industry programs are aimed at improving the status of service employees. Overall employee relations should continue to improve.

- Relations between consumers and the trade channels must be considered strained. Consumers' major complaints are poor workmanship, performance of unnecessary repairs, time consuming and inconvenient service, high repair costs, and a general lack of interest on the part of the trade channels. Growing disenchantment with the industry has created pressures from consumer groups, making the maintenance and repair of automobiles a political issue. The public's well-known "love affair" with the automobile, combined with high personal dependence on this transportation mode, has naturally created high consumer expectations. It should be recognized that no other consumer product or service is the subject of equally high expectations held by such a large segment of the population.

- The trade group is making major efforts to meet consumers' expectations. This task has become increasingly difficult, however, due to the following factors:

    - Rapid introduction of new and/or more complex vehicles, especially in regard to training, equipment, and parts inventory requirements.

- Sharp increases in operating costs.

As with other major industries, the I/M/R Trade Group is subject to increasing disregard for quality standards and productivity.

- The support group is providing substantial assistance in closing the consumer expectation gap. Recent examples are: product quality improvements, reduction of vehicle maintenance and repair requirements, improved warranty conditions, and the use of arbitration programs.

- Recent charges against the integrity and competence of the I/M/R industry have created an atmosphere of confrontation between Federal and State government and the industry. Government is obviously interested in safeguarding the considerable efforts vested in the design and production of fuel-efficient, safe, pollution-free automobiles, while at the same time keeping the automobile life cycle cost at a minimum. Industry recognizes that a problem exists, but believes that cooperation, not confrontation, is the answer. In order to improve this relationship, Federal and State government should consider increased passage of "supportive legislation" as successfully demonstrated in Western Europe.

3.3 MANUFACTURERS' WARRANTY

3.3.1 A Definition of Warranty

Modern dictionaries define warranty as:

"...the seller's assurance to the purchaser that the goods shall be as represented..."

Around this rather short and concise statement consumers, manufacturers, and regulatory bodies have woven an extremely complex system of warranty terms and provisions.

While this study deals only with the automotive industry, it will be helpful for the reader to become familiar with the entire range of warranties covering simple, inexpensive products as well as very complex and expensive items such as modern automobiles.

As a general rule, it can be anticipated that the complexity of a warranty policy will be in direct proportion to the technical sophistication of the article it covers. In the market place, uncomplicated items are visually evaluated by the consumer at point of sale and acquired without a written warranty. Their proper performance "as represented" is assured under an implied warranty of performance for the intended purpose.

As goods become more complicated and expensive, other criteria come into play. This incremental acceleration of the various decision levels is reflected as follows:

<u>First Level</u>:

Visual inspection reveals quality, immediate results from use test.	unwritten, implied warranty

<u>Second Level</u>:

Visual inspection not conclusive, more extensive use necessary to determine quality,	written, express warranty, includes disclaimers, owner's obligations, etc.
user treatment of goods becomes important method of use influences performance,	written, express warranty, includes disclaimers, owner's obligations, etc.
outside influences become a factor	

<u>Third Level</u>:

Includes all factors of second level product very complex-many parts and components product is a high cost item	very specific warranty contact covering all possible factors.

Simple articles fall into the FIRST LEVEL of the chart. The SECOND LEVEL applies to more complex articles produced in quantity and accompanied by a written warranty. The automobile fits into this classification. The THIRD LEVEL of complexity is reserved for very large, complex, and expensive products accompanied by a warranty contract specifically written for each occasion.

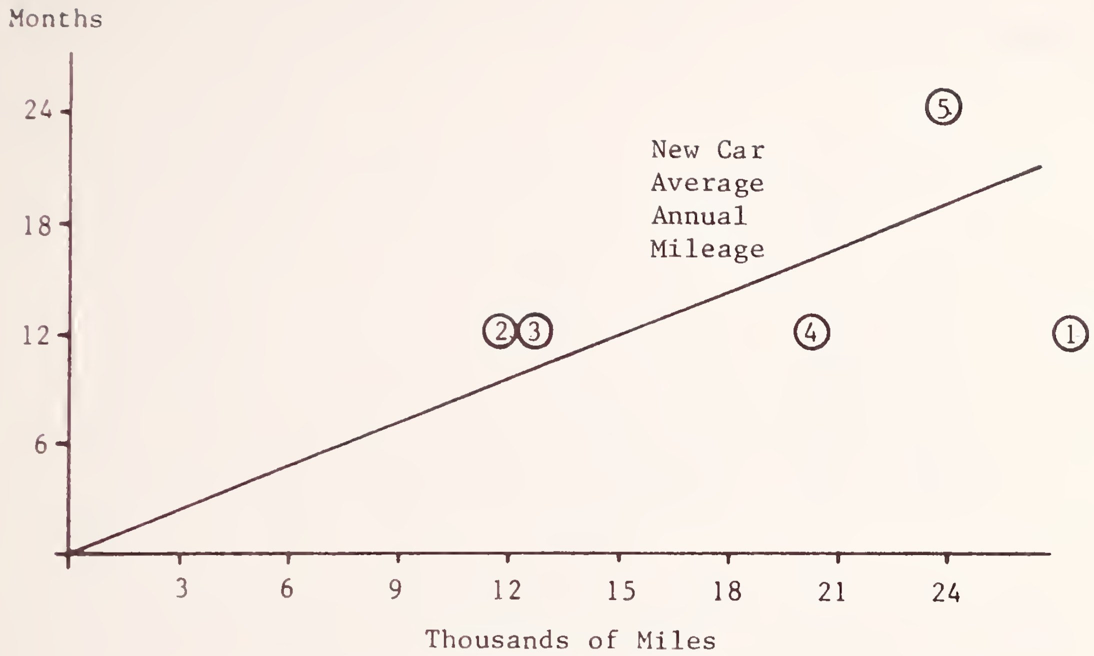
3.3.2 Current Warranty Policies and Procedures of Auto Manufacturers

The information contained in the following section was obtained from a number of domestic and European automobile manufacturers. The same request was directed to Japanese companies selling in the U. S.; however, they were unable to participate in the review. Nonetheless, some of the key elements of their warranty practices are public knowledge and are a part of this report.

In general, it can be said that there is relative uniformity in warranty coverage and policy features among the major car companies. Obviously, this is partly because of competitive reasons and partly the result of a legislation framework which applies to all firms selling automobiles in this country.

3.3.2.1 New Car Warranties - The basic coverage of "no cost" new car warranties for thirteen makes surveyed, as listed in Table 3-2, is 12 months, except for Mercedes-Benz which is 24 months. Mileage limitations vary from 12,000 miles (all domestics surveyed) to 24,000 (Mercedes-Benz). In addition, there is an increasing trend to unlimited mileage allowances during the warranty period. Seven imports offer (Figure 3-2) unlimited mileage allowances within their 12 month warranty timeframe. These terms are also used for the Diesel engine version of some domestics. This approach simplifies decision making and poses no undue financial risk, since the average mileage driven by new cars the first year is about 15,000 miles.

With few exceptions all warranties are limited warranties and they are transferable to a second owner should the car change hands during the new car warranty period. Tires are not included in the manufacturer's new car warranty, but fall under the tire manufacturer's warranty coverage. If tire failure occurs during the vehicle warranty period, the tire is usually replaced. For defects occurring after the expiration of the vehicle coverage, a pro-rata system based upon the remaining tread depth is in force. Some new vehicle dealers are also



New car warranties range from a minimum of 12/12 to a maximum of 24/24. The trend is to warranties with time limits only.

1 = 12/ unlimited miles : Subaru, BMW, Peugeot, Saab, Volvo, Porsche/Audi

2 = 12/12,000 miles : General Motors, Chrysler, Ford

3 = 12/12,500 miles : Toyota, Datsun

4 = 12/20,000 miles : Volkswagen

5 = 24/24,000 miles : Mercedes-Benz

FIGURE 3-2. NEW CAR WARRANTY TIME AND MILEAGE LIMITS agents of tire companies and, as such, can offer warranty services for tires on the makes in question. All other tire claims are handled through the appropriate tire company representative.

Traditionally, U. S. manufacturers allow more liberal coverage for batteries, radios, and air conditioning units installed in new vehicles than do import manufacturers. Batteries enjoy a pro-rated coverage after the expiration of the new car warranty. The mileage limitation is dropped for air conditioning units and radios, i.e. they are covered during the 12 month warranty period despite exceeding the mileage limitations. This policy is not used by import manufacturers: they provide the same coverage for all original equipment items except tires. On the other hand, imports extend the same new vehicle protection to items like paint, upholstery, convertible tops, trim items, and wear and tear items, as well as service items. Domestic makes either exclude some of these or offer reduced coverage, expecially for wear and tear service items.

Without exception, all new car warranties specifically exclude incidental or consequential damages, such as loss of use of the vehicle, loss of time, inconvenience, expenses for telephone, expenses for gasoline, travel or lodging, etc. Further, they are unanimous in stating that "THIS WARRANTY IS THE ONLY EXPRESS WARRANTY MADE BY .. (MANUFACTURER) .. APPLICABLE TO THIS VEHICLE, ANY IMPLIED WARRANTY APPLICABLE TO THIS VEHICLE IS LIMITED IN DURATION TO THE DURATION OF THIS WRITTEN WARRANTY". A disclaimer protects the manufacturer in those states or provinces where exclusions or limitations are not allowed. At this time Kansas, Maine, Maryland, Massachusetts, Vermont, and West Virginia ban any limitations on implied warranties.

Under mandates of the Environmental Protection Agency, all new vehicles carry a 5 year/50,000 mile warranty on emission control components, which assures the buyer that the car was designed, built, and equipped so as to conform during this period to all applicable EPA regulations. It further protects the owner should a defect in material or workmanship cause the car to fail to comply with such regulations. Generally, U. S. firms include a specific list of parts and components covered under the emission warranty. The imports merely state that the dealer will make such repairs as may be required by such regulations. This has given cause for some disharmony among customers and dealers, and may lead to an effort by the EPA to require car manufacturers that the list of covered items become part of the emissions certification process.

All manufacturers list examples of items which are not covered under their new car warranty. These are usually regular service adjustments, cleaning or bleeding processes, wheel alignment, and normal wear to chrome and other appearance items. In this category, the import manufacturers participating in the survey provided a more complete and clear list than their domestic counterparts.

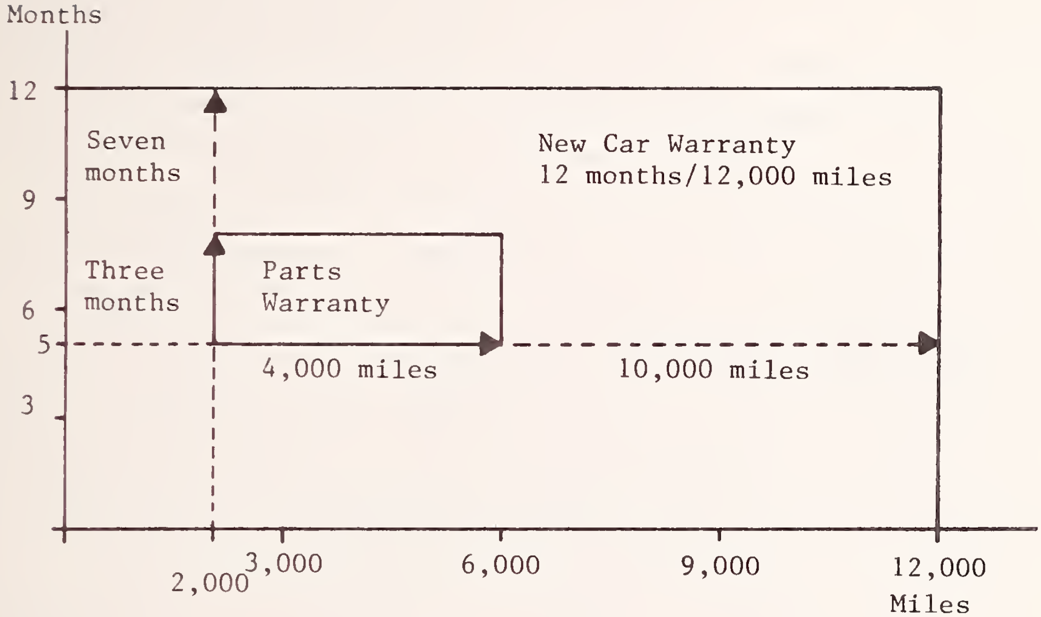
The warranty policy given to the customers of all makes also includes a list of circumstances which will void the manufacturer's coverage of their vehicles. Heading the list is speedometer tampering, lack of recommended maintenance, abuse, modifications not approved by the manufacturer, overloading, participation in competitive events, installation of non-factory parts or components, and repairs by other than franchised dealers, if such repairs lead to a future defect.

3.3.2.2 Spare Parts Warranty - All manufacturers provide a warranty for genuine factory parts installed by franchised dealers during repairs. The parts warranty period for imports is 6 months/6,000 miles, and for domestic car manufacturers, 3 months/4,000 miles. This period may be extended to the expiration of the new car warranty period, if the part was installed at an early stage in the operation of the vehicle. As an example, consider a car covered by a twelve month/12,000 mile warranty and a spare part covered by a three month/4,000 mile warranty. If the spare part is placed in this vehicle at 2,000 miles, it would be warranted under its own warranty for four thousand miles. In practice, it is protected for an additional 6,000 miles under the new car warranty, at least as far as mileage is concerned. The same reasoning applies to time, of course, in combination with the miles driven. Figure 3-3 provides an example.

3.3.2.3 Corrosion Warranty - In 1979 American Motors, the Ford Motor Company and General Motors introduced a three year, unlimited mileage corrosion perforation warranty. Under this coverage any part which in normal use develops perforation from rust within three years of first delivery or use of the vehicle will be repaired or replaced free of charge. Because of the rust policies pioneered by AMC and Ford, as well as increasing pressure from consumer groups and government agencies, other car manufacturers are expected to offer similar warranties for their products in the near future.

While such warranties may seem to be a substantial concession to consumer interests, they are almost meaningless inasmuch as the corroded part must display complete perforation - a process which generally takes longer than three years for late model vehicles receiving rust protection treatment at the factory. In addition, the warranties specifically exclude parts that have been damaged and repaired.

3.3.2.4 "Hidden Warranties" - More than half of the auto manufacturers providing information indicated that they are accepting financial responsibility for some repairs performed after the expiration of the warranty period. Such payments are referred to as "policy adjustments", "goodwill adjustments",



A part installed within the new car warranty period is covered by both the parts warranty and the remainder of the new car warranty.

Example:	New car warranty	=	12 months / 12,000 miles
	Part installed	=	5 months / 2,000 miles
	Parts warranty	=	3 months / 4,000 miles
	Actual coverage	=	7 months / 10,000 miles

FIGURE 3-3. SPARE PARTS WARRANTY WHEN INSTALLED DURING NEW VEHICLE WARRANTY PERIOD

etc., and in general serve to retain a customer's goodwill and to protect the reputation of the product. The practice is followed by domestic and import manufacturers, and it is safe to anticipate similar arrangements even from those answering this question in the negative. There are basically two types of unwritten policies, stated and unstated, and only the former is acknowledged to exist. The stated policy deals with each request for adjustment individually and does not cover any particular defect or vehicle component. As one manufacturer puts it, "a policy adjustment is a discretionary, goodwill action taken when the cause of a customer's dissatisfaction may not be covered by, or may go beyond, our warranty. While the terms of our warranty apply to all purchasers of our products, policy adjustments are considered one at a time based on the merits of each individual circumstance."

The unacknowledged policy is reflected in the unconfimed practice which has received much attention from the public and investigative bodies. Reportedly, upon recognition of a premature failure or design weakness of a non-safety related nature, a manufacturer may elect to accept claims for this specific repair for a specific extended time period after the expiration of the warranty coverage. The dealer body will either be notified of the extension or will find out through trial and error that the manufacturer will accept warranty claims for this particular repair. Owners of vehicles potentially subject to the defect are not normally advised that a problem may exist. Consumer groups contend that this "secret warranty" system is not in the best interests of the customer, and that manufacturers should be required to publish such warranty extensions and notify all affected owners accordingly. It is argued that otherwise, only a portion of the affected owners will receive free repairs through the warranty extension. Those who do not learn of the warranty extension will either not have the repairs performed, or will pay for repairs that others received at no charge.

Manufacturers, on the other hand, argue that rather than publish and notify, they should do neither, and let the customers pay for a repair that otherwise would have been covered by the warranty extension. The reasoning is that publication will lead to unjustified claims by non-affected owners and unnecessary repairs or inspection in cases where the problem affects only part of a particular batch of components. Further, the administrative costs of handling mandatory publication and notification would inevitably increase the cost of vehicles, which would be contrary to the best interests of consumers. It must also be recognized that manufacturers have a competitive interest in not publicizing problem areas.

3.3.2.5 Administrative Detail - With the exception of one domestic manufacturer, all manufacturers require that warranty repairs be performed only by franchised dealers. Exceptions can be made if a defect occurs in a location where there is no franchised dealer, and the car cannot be driven to the closest dealer.

Most companies allow their dealers to make claim decisions while the customer is in their service driveway. From 68 percent to 90 percent of their warranty claims originate there. Only one U. S. manufacturer reserves the right to decide the eligibility of most (87 percent) claims in its central warranty department.

Claim data are transmitted from the dealer to the factory offices either via mail or via teleprocessing methods. About half the auto manufacturers providing inputs use automated data carriers from the inception of the claim; all of the manufacturers use data processing means for the remaining processing steps.

One hundred percent submission of replaced parts (return to the factory) is used by one low volume import. All others, as with the domestic manufacturers, either dispose of the parts in the dealership after payment of the claim or spot check parts at the dealership or at factory technical offices. In no instance did factory field service representatives check more than 8 percent of the claim information or replaced parts at the dealership.

All manufacturers provide suggested repair times, which when multiplied by the warranty labor reimbursement rate, determine the labor portion of claims. Parts are reimbursed at dealer cost plus a handling charge, which for most makes was reported to be 30 percent.

Labor reimbursement rates are generally reviewed upon request only. Most manufacturers offer three alternative ways of arriving at a warranty labor rate. Plan A is a rate equal to the dealer's posted retail labor rate. This option has been available to most domestic dealers for almost two years and is used by 50 percent of the agencies. Plan B is based upon mechanics' hourly wages plus a factor to cover unitemized expenses and fringe benefits. This plan is also known as the "short form". Plan C is also based upon mechanics' wages, but allows the dealer to itemize fringe benefits. This version is used by dealers under collective bargaining agreements, where fringe benefits are often substantial.

Lubricants, fluids, freon, and brake fluid are reimbursed by all except one German import. The same importer reports that its dealers are breaking even on warranty work; all others believe that their dealers produce a profit on warranty repairs.

Processing time from repair to payment varies. One German import reimburses 95 percent of all claims within twenty-eight days from the day of repair. Such quick turnaround requires fast claim submission on the part of the dealer and maximum automation of claim processing. Domestic makes are generally somewhat slower in settling their claims. Routine transactions are settled within forty-five days provided there are no questions concerning the claim, and provided the dealer does not delay submission. To compensate for the slower turnaround, most manufacturers in this category pay the dealer a warranty advance. This "float" is based upon the normal claim volume and cost for one month and varies from dealer to dealer.

As mentioned earlier, there is little difference between the warranty policies of the various manufacturers, either domestic or imports; while German imports provide longer mileage coverage, the U. S. makes offer optional service contracts. Automation of claim administration is a strong factor in all cases, and claim transmission and pricing policies are essentially identical. Despite their similarities, there are drastic differences in the effectiveness of the systems, as explored below.

Optional extended warranties/protection plans/service contracts are discussed in Section 3.3.5.

3.3.3 Effectiveness of Current Systems

Ideally, a realistic evaluation of the effectiveness of a manufacturer's warranty practices can only be made by customers using the product. They are the ones who feel the ultimate effect on the warranty when warranty work is required on their vehicles. Unfortunately, it is not economically feasible to conduct a customer survey for this purpose alone.

Another method of determining the customer's opinion would be an analysis of complaints received by the factories' customer relations departments. Without exception, this information is classified and not disclosed for analysis outside corporate offices. An excellent reflection of a manufacturer's warranty practices can also be obtained by analyzing the dealer network. The dealer is the initial recipient of the customer's complaint and usually shares his frustration if no relief is obtained from the factory. The same rationale was used by NADA in 1976. Its Industry Relations Committee conducted a survey among U. S. car dealers to learn how customers, as well as dealers, are affected by warranty administration procedures. Some of these findings are especially significant when viewed in relation to a more recent survey of dealers conducted by Nichols, Campbell, and Morrow, Inc., of Kansas City, Missouri.* This study is based on comments provided by 612 dealers representing three domestic makes, one hundred dealers representing three European volume imports, and 28 dealers representing two major Japanese makes. Table 3-7 reflects the opinion of domestic, European, and Japanese import dealers as to the protection of the customers' interest by current warranty policies.

From these figures it is clear that considerable difference exists between domestic and import dealers' perception of the purpose of manufacturers' policies. The Japanese import dealers are more specific in both their positive and negative evaluations. Overall, their perception of manufacturers' warranty policies is more favorable to the customer than that of domestic and European import dealers.

A comparison of current figures with the 1976 NADA survey shows an interesting development. When all positive replies to the question of protecting the consumers' interest are extracted, a definite shift of opinion becomes evident.

Current responses as reflected in Table 3-8, would indicate that the industry as a whole has gained a more favorable image in the perception of its dealers. Domestic manufacturers follow the total industry trend. European makes have made substantial improvements in their rating, while the Japanese have experienced a setback. Available data provides no ready explanation for this shift.

*Business Management Consultants to, and organizers of, "Dealers 20 Group".

TABLE 3-7. PROTECTION OF THE CUSTOMERS' INTEREST

Question: Does the manufacturer's warranty protect the interest of the customer?

Rating	Dealers of U.S. Manufacturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manufacturers %
Very much so	46.9	59.4	69.5	51.4
Sometimes	51.1	40.6	26.8	46.7
Not at all	2.0	0.0	3.7	1.9

Source: Nichols, Campbell & Morrow, Inc., 1979

TABLE 3-8. PROTECTION OF THE CUSTOMERS' INTEREST, 1976 - 1979 COMPARISON

Statement: The customer's interest is protected by factory warranty policies.				
Survey	Dealers of U.S. Manu-facturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manu-facturers %
1979 Status	72.4	79.7	82.9	74.8
1976 NADA Survey	67.9	64.8	89.4	69.1
Change +/-	+ 4.5	+ 14.9	- 6.5	+ 5.7

Source: National Automobile Dealers Association, 1976
Nichols, Campbell & Morrow, Inc., 1979

Experience has shown that dealers perceive a strong relationship between their interests and the customers'. Table 3-9 analyzes this correlation.

TABLE 3-9. PROTECTION OF THE DEALERS' INTEREST

Question: Does the manufacturer's warranty protect the interest of the dealer?				
Rating	Dealers of U.S. Manufacturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manufacturers %
Very much so	24.3	40.6	42.2	28.8
Sometimes	65.2	53.1	48.2	61.4
Not at all	10.5	6.3	9.6	9.8

Source: Nichols, Campbell & Morrow, Inc., 1979

Less than 30 percent of the dealers of all makes feel, without reservation, that their interests are protected by current warranty policies. Over 60 percent believe their interests are protected sometimes, and almost 10 percent believe their interests not to be protected at all.

Domestic dealers rated their manufacturers lowest in the "very much so" category, and highest in the "not at all" responses, thus producing the lowest overall rating of the three groups.

A high 40.6 percent of European import dealers and an even higher 42.2 percent of the Japanese import dealers feel very much protected by their manufacturers' policies. Japanese import dealers are, however, close to the industry average in their distrust of factory practices, while only 6.3 percent of the European import dealers feel "not at all" protected.

The same issue was touched on during the 1976 NADA study. If today's findings are compared with those obtained three years ago, a significant change becomes evident as reflected in Table 3-10.

TABLE 3-10. PROTECTION OF DEALERS' INTEREST
1976 - 1979 COMPARISON

Statement: The dealer's interest is protected by factory warranty policies.				
Survey	Dealers of U.S. Manufacturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manufacturers %
1979 Status	77.3	73.4	69.3	75.8
1976 NADA Survey	49.3	48.4	78.5	45.6
Change +/-	+ 28.0	+ 25.0	- 9.2	+ 30.2

Source: National Automobile Dealers Association, 1976
Nichols, Campbell & Morrow, Inc., 1979

Actual percentages are of minor importance in relation to the definite trend manifested over the last three years. The entire industry, and with it the domestic companies, has improved its credibility with dealers by a healthy 30 percent. European manufacturers are showing improvement, while Japanese makes have lost over 9 percent in this confidence measurement.

Table 3-11 deals with the dealers' perception of the fairness of the manufacturers' warranty decisions. It leads to some conclusions as to the trend revealed by the previous charts. There are four possible responses to the question of fairness, ranging from very positive to very negative, with two intermediate steps.

TABLE 3-11. FAIRNESS OF WARRANTY DECISIONS

Question: Are the manufacturers' warranty decisions					
Rating	year	Dealers Of U.S. Manufac. Turers (%)	Dealers Of Euro- Pean Im- Ports (%)	Dealers Of Japa- Nese Im- Ports (%)	Dealers Of all Manufac- Turers (%)
Consistently fair and impartial ?	1976	24.4	26.2	58.1	26.7
	1979	22.1	41.7	45.8	27.8
	+/-	- 2.3	+15.5	-12.3	+ 1.1
Inconsistent but fair?	1976	41.4	41.2	34.9	41.0
	1979	50.4	47.9	41.0	48.9
	+/-	+ 9.0	+ 6.7	+ 6.1	+ 7.9
Sometimes unfair and arbitrary?	1976	28.9	25.1	5.4	27.2
	1979	27.1	10.4	13.3	23.0
	+/-	- 1.8	-14.7	+ 7.9	- 4.2
Always unfair and arbitrary?	1976	4.2	5.2	8.5	4.0
	1979	.4	.0	.0	.3
	+/-	- 3.8	-5.2	- 8.5	- 3.7

Source: National Automobile Dealers Association, 1976
Nichols, Campbell, and Morrow, Inc., 1979

There is little doubt that a dealer's attitude towards his factory, at any time and on any issue, correlates with the success of the dealership at the time of the poll. It is not improbable that this phenomenon is reflected in the findings of Table 3-11. It is a matter of record that during the 1975/76 years some European imports suffered severe supply and/or product problems resulting in reduced income for their dealers. This condition has improved considerably in the interim, and may well be reflected in the more positive attitude of the dealer body.

Dealer size, in all likelihood, also has an influence on the attitude displayed. The NADA survey supported this opinion: As the sales volume of the dealerships surveyed increased, dealers felt their interests and their customer's interests were <u>less</u> protected by the manufacturers' warranty policies. No current data in this connection are available.

In addition to the key issues touched upon above, there are some basic facts which help to put the warranty question into the proper perspective. The first two items of interest, which should be reviewed simultaneously, are the volume of warranty work in relation to total shop capacity and the profitability of warranty repairs. Unfortunately, some manufacturers considered this information confidential, thereby narrowing the basis for evaluation. However, the comments received were very uniform, and state in summary that not more than 20 percent of a dealers' total labor capacity is devoted to warranty work. According to NADA, in 1978 warranty sales accounted for 11.2 percent of total dealer labor sales and 8.3 percent of total dealer parts sales. This is surprising to some degree, since only a few years ago it was not uncommon for a domestic dealer to perform as much as 45 percent of his work in the form of warranty labor. The warranty labor reimbursement rate paid to dealers is either lower than or equal to their customer labor rate. It must be kept in mind, though, that the effective labor rate collected from retail customers per hour worked is lower than the posted customer labor rate in almost every instance analyzed, due to discounts, special prices, and adjustments made for retail customers. It can safely be said, therefore, that the warranty labor rate is very close to the effective customer labor rate, or even higher in some instances. Thus, it is not surprising that dealers, as well as manufacturers, report that warranty repairs generate a profit for the dealer. Over two thirds of the Japanese import dealers reported warranty work as profitable, followed by half of the domestic dealers and slightly less than half of the European imports dealers. The latter also had the highest rate (18.8 percent) reporting a loss on warranty work.

Automation is used to varying degrees by dealers of almost all makes. The survey clearly showed that, in the dealers' perception, the administrative effort in claim processing was reduced in direct proportion to the degree of automation in effect. At the time of this report, European imports have the most sophisticated systems, with minimum efforts for the dealer; Japanese companies are working with the least automation in this phase of their business.

In summation, Japanese manufacturers rate highest with their dealers as far as warranty policies are concerened. Dealer and customer are considered to be well-protected, factory decisions are fair and impartial, and warranty work is profitable for most of the dealers.

European import dealers rate their factories slightly less favorable in warranty handling, but still substantially higher than domestic dealers rate their manufacturers. However, over the last three years the lead of the Japanese over the European imports in this respect has narrowed. The position of the domestic manufacturers in this area remains essentially unchanged.

European imports appear to lead in the warranty processing administrative practices. Submitting claims is relatively simple, automation is used to a high degree, and 95 percent of all claims are paid as submitted. The Japanese fare worst in this category, with difficult claim processing and limited application of data processing methods.

3.3.4 Regulatory Impact on Warranty Practices

In the last ten years there has been more warranty related rule-making than in any other like period in the past. This regulatory activity has taken place at the Federal level, as well as in the more "progressive" states. Without a doubt, the growth of a more unified consumer movement in the seventies has been largely instrumental in moving consumer related legislation to the forefront. Independent consumer organizations and official agencies at all levels of government have been created.

The effect of this concentrated effort was most pronounced on the vehicle manufacturer, was felt more moderately by the retail organizations, and went largely unnoticed by most retail customers not directly involved in consumer activity. Independent repair facilities were, until recently, only marginally concerned with the results of new product warranty legislation.

There are two warranty related pieces of legislation which set the standards for the country. California enacted the Song-Beverly Consumer Warranty Act applicable to consumer goods manufacturerd on or after March 1, 1971. The Magnuson-Moss Warranty-Federal Trade Commission Improvement Act was enacted in January 1975, to become effective six months thereafter. Many states have adopted some parts of these acts directly or in modified forms. For the sake of brevity, these two acts will be used to study the impact of new product warranty practices.

In broad terms, the legislation did not introduce any condition or benefit to the consumer which was not already available under the rules of logic and fairness to all parties involved in a warranty dispute. It merely attempts to define some of the more abstract conditions and provides guidelines of a general nature. A conscientious manufacturer, producing a quality product, and maintaining a high integrity dealer network, in all likelihood, had to make very few changes because of this new legislation.

Some of the more significant details of the acts are identified below, with (SB) standing for the Song-Beverly Act and (MM) for the Magnuson-Moss Act.

Wording of the Warranty (SB/MM)

Both acts stipulate that warranty language must be "readily understood...fully and conspicuously disclose in simple terms the conditions of the warranty...". This requirement has done much to simplify written warranties and make them more readily understandable to the average consumer. A comparison of a recent warranty statement with a pre-legislation one will quickly demonstrate this difference.

Availability of Service (SB)

The manufacturer must either "maintain...sufficient service and repair facilities...or be treated under the act as if he was a service and repair facility...". Retail sellers must make repairs and have recourse against the manufacturer for reimbursement of the repair costs plus a reasonable profit."

Time Allowed for Repair (SB/MM)

While SB gives a flat 30 day period for performance of warranty repairs, MM requires the warranty language to contain the manufacturer's own figure.

Replacement of Goods (SB/MM)

If the goods cannot be repaired, the manufacturer must either replace the goods or reimburse the buyer in an amount equal to the purchase price "less the amount directly attributable to use by the buyer prior to discovery of the nonconformity." There has been much discussion in the auto industry on this point because of the ambiguity of the depreciation formula to be applied.

Designation of Warranties (MM)

Requires manufacturer warranting a consumer product by means of a written warranty to designate such warranty as FULL (duration) WARRANTY or a LIMITED WARRANTY.

Federal Minimum Standards for Warranty (MM)

Section 104 of the act sets forth Federal minimum standards for written warranties.

Tolling the Warranty Period (SB/MM)

The warranty period is extended under this provision to compensate for time the consumer has been deprived of the product's use because of repairs under warranty.

Duration of Implied Warranty (SB/MM)

"Implied warranties may be limited in duration to the duration of a written warranty of reasonable duration, if such limitation is conscionable and is set forth in clear and unmistakable language and prominently displayed on the face of the warranty." Six states--Kansas, Maine, Maryland, Massachusetts, Vermont and West Virginia--ban such limitaion.

Of major interest to the automotive industry is legislation now before the House Commerce Consumer Subcommittee. The bill, sponsored by Representative Bob Eckhardt, Texas Democrat, in essence would amend the Magnuson-Moss act to require a full warranty on all new vehicles, require makers to buy back "lemons," offer loaner cars if repairs take too long, and eliminate the requirement for at least 100 named plaintiffs in any class action suit under the act.

There is considerable debate on this bill with strong arguments pro and con being offered. While consumer oriented parties cite case after case of warranty related complaints, manufacturers call the proposed bill extreme and counter-productive in its present wording. A NADA spokesperson states that "full warranties will not change the way cars are made or repaired. All that will change is a rise in consumer expectations and an overall drastic increase in cost of repair." Consumer groups fear that, if not moderated, the proposed law might cause auto manufacturers to drop their express warranties and only offer consumer paid service contracts presently not covered by Magnuson-Moss.

Emission warranties are as important to the independent repair and maintenance industry as they are to manufacturers and new vehicle dealers. The Federal Trade Commission (FTC) is concerned about the anticompetitive nature of proposed emission performance warranties sought by the EPA and the State of California. According to a statement made by the FTC on the California waiver request, "while most auto service (in California) is done by independent garages, body shops, and gas stations, using parts made by independent manufacturers, the California warranty would encourage owners to use original equipment parts and have the work done at franchised dealers." Far from being decided, this issue poses vital questions and requires full and unbiased deliberation.

3.3.5 Service Contracts

Executives of Service Contract companies are united in their opinion that the fast rise of service contracts during the last eight to ten years is directly related to the consumer movement. Conservative estimates are that a service contract is sold with about one of every two new cars. The service contract, or extended warranty, is not new. Historically, it started with oil companies giving dealers a bonus of "engine warranty slips" for a given quantity of oil purchases. These slips in turn were sold to customers in the form of a surcharge on engine oil purchased. Oil companies warranted a customer's car against major engine repairs if he could produce enough "slips" which showed that oil changes have been regularly made, using the issuing company's products.

Up until a few years ago there was no clear distinction between a service contract and an extended warranty. The passing of warranty legislation on state and Federal levels has encouraged a more precise definition of the two terms. In an interpretation of the Magnuson-Moss Federal Warranty Act, the Federal Trade Commission has ruled that: a warranty sold on an optional basis for an additional charge to the price of the car, is a SERVICE CONTRACT. California's Song-Beverly Act is equally specific in its wording on this issue. It defines a warranty as: accompanying the goods as part of the sales contract with no extra or separate cost to the buyer. It follows the Magnuson-Moss Act in its language on service contracts.

Historically, car manufacturers have shared the market with independent warranty and oil companies. Both groups sold extended warranties to new and used car customers. Independent companies mostly provided used car contracts, while manufacturers concentrated on their new models. Insiders to the business freely admit that early programs were not operated very well. Because of consumer resentment and bad publicity, extended warranty practices came to the attention of the Federal Trade Commission and State Departments of Insurance. In the formative stages of corrective legislation there was much uncertainty causing most of the car manufacturers to drop out of the market temporarily. Independent service companies, dependent on continued sales, petitioned the FTC for an interpretation of the provisions of the Magnuson-Moss Act. The FTC found that under the Uniform Commercial Code a manufacturer or dealer is permitted to be a warrantor or service contractor, but if a third party does so, it is acting as an insurance company, and as a consequence must do business as an insurance company.

In the first half of 1979, General Motors, Ford, and Chrysler reentered the market with extended coverage plans for at least some of their models. This move is opposed by independent service firms, who claim that it potentially denies fair opportunity to new car buyers if a new car dealer sells his manufacturers' extended contract exclusively. As an illustration of their position they state that the typical contract of an independent insurer has a 5-year/50,000 mile duration and sells for $225.00. Auto maker contracts are typically of a 3-year/36,000 mile duration and sell for $175.00.

From the consumer's point of view, a well-written contract by a reputable underwriter may well be worth the premium. If limited to the anticipated ownership period of the vehicle, it normally covers the consumer against failure of the drive train, front suspension, power steering, and air conditioner. It may also include towing and rental car expense while the car is being repaired. Most contracts feature a deductible of $25.00 and up per occurance, and may or may not put a ceiling on the cost of the individual job. All call for proof of proper maintenance, especially sufficient lubrication of moving parts.

Because of the time span covered by newer plans, they are usually still in effect when the car is sold to the next owner or traded in on a new vehicle. The contract is transferable, but this detail may not be given proper attention at the time of trade. Therefore, it is not improbable that only a certain percentage of contracts are taken advantage of while their coverage is in effect. Transfer procedures are relatively simple, and there is usually no refund of the unused portion of the plan if the car is sold prior to its expiration.

Judging by the lively competition in the marketplace, the service contract business must be a lucrative one for both the dealer and the service company. The dealer retains about 40 percent of the premium when the contract is sold; customers are expected to return to him for repairs under the contract, thereby providing a tie with the customer which extends beyond the new car warranty. Repairs performed under the contract are mostly reimbursed at full retail price and, though an intangible asset, the extended coverage is valuable in eliminating the customer's possible product dissatisfaction in case of a defect. Competent underwriters in turn know the quality and failure rate of the products they cover, and can realize a handsome return on investment if their calculation is correct and if their sales personnel use discretion in the selection of the dealers they sign up.

3.3.6 Recall Campaigns

The National Highway Traffic Safety Administration maintains an aggressive vehicle defect reporting and recall program. In 1978 the I/M/R industry, specifically new vehicle dealers, had to deal with a total of 9.06 million recalled vehicles. If all customers complied with the recall requests of 1978, this activity alone would mean a daily volume of 36,000 cars in dealer service departments, using capacity, personnel, and capital resources which would otherwise be needed for normal maintenance and repair activities.

There are no performance data on recalls other than original campaign information, which is a matter of public record with NHTSA. Car manufacturers closely guard technical details, cost figures, and completion ratios of recall activities. Simple arithmetic, however, reveals the extent of financial involvement for the automobile industry.

Using the above figure as a guide, an example based on the recall of nine million vehicles can be constructed. This means notification of the customer and dealer body, supplying repair instructions and parts to dealers, and record keeping and progress reporting to NHTSA. Conservatively, a $10.00 average administrative cost per vehicle recalled appears justified. There are no figures available as to the cost of parts and labor per campaign. Using an average labor involvement of 0.5 hours per vehicle, an average national labor rate of $28.00/hour, and an equal amount for parts, one could expect a cost of $38.00 per car of $342 million per year for the industry. While there are no concrete facts to support this calculation, it gives an idea of the volume of business involved in recall campaigns.

The effectiveness of the massive recall effort intended to improve vehicle safety has not been determined. There are no public records showing how many of the cars subject to recalls were actually brought to the dealer for repairs or replacement of defective components. There are data from the retail level, though, which give a good indication of the effectiveness of recall activities, as shown in Table 3-12.

The industry is rather unanimous in the opinion that recalls are effective. European imports are the most positive in their judgement while a larger number of domestic dealers find recall campaigns "not at all" effective.

Table 3-13 shows a completion rate of 60.8 percent of all cars involved in a typical recall. While this may be regarded as a creditable performance, it also reflects a degree of consumer apathy or fear of additional charges present in those cases where the potential safety defect does not result in a noticeable deterioration of the vehicles' performance. Other reasons for the noncompletion of a recall include the

TABLE 3-12. EFFECTIVENESS OF RECALL CAMPAIGNS

Question: How would you rate the effectiveness of recall campaigns?				
Rating	Dealers of U.S. Manu-facturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manu-facturers %
Very effective	7.5	16.5	12.0	9.7
Effective	68.6	64.9	66.3	67.5
Not at all effective	23.9	18.6	21.7	22.8

Source: Nichols, Campbell & Morrow, Inc., 1979

TABLE 3-13. RECALL CAMPAIGN RESPONSE RATE

Question: How would you rate the response of customers to a typical recall campaign in your dealership?				
Results	Dealers of U.S. Manufacturers %	Dealers of European Imports %	Dealers of Japanese Imports %	Dealers of All Manufacturers %
Cars checked as required	59.3	66.7	62.8	60.8
Customer not responding	26.0	21.0	22.1	24.9
Unable to contact customer	13.4	12.7	12.4	13.2
Non-participation for other reasons	7.9	9.5	7.1	8.0

Note: Because of overlapping answers, the percentages in each column do not add to 100 %

Source: Nichols, Campbell & Morrow, Inc., 1979

wrecking of the vehicle, loss of contact, and others not related to customer reaction.

Dealers were also questioned as to the manufacturers' efforts in the preparation and execution of campaigns. Responses were uniform among the main dealer categories and showed that:

Dealers are notified in time	55.7 percent
Repair instructions are satisfactory	90.8 percent
Parts are available for start of campaign	24.9 percent
Completed action is easy to report	86.7 percent
Prompt payment is made for campaigns	72.0 percent
Good follow-up occurs on outstanding cars	53.6 percent

There is very little variance between domestics and imports in all of the above answers. The weakest areas are timely notice to the dealer of an impending campaign and the availability of necessary parts once customers have been notified. Both of these points are not infrequently raised by customers as a result of advance press coverage of a NHTSA investigation of a certain defect which eventually may lead to a recall. As soon as such investigations are reported in the media, potentially affected customers begin to call dealers, while the actual start of the recall campaign, if initiated, may be still months away.

Finally, customers; reaction to a recall was rated by the dealers. They felt customers are:

Glad to comply with request	49.9 percent
Unhappy, but bring car in	26.9 percent
Must be urged to bring car in	19.6 percent
Refuse to have work done	12.0 percent

(Note: Because of overlapping answers, these percentages do not add to 100)

United States vehicle owners lead the industry by a very small margin except in the first question, where European import owners have a 10 percent lead.

3.4 AFTERMARKET PARTS SUPPLY

3.4.1 Industry Trade Channels

The automotive aftermarket is a term used to encompass the products and services which provide replacement parts, add-on accessories, chemicals, and the fuels needed to properly operate, maintain, repair, and adorn vehicles after manufacture.

Automotive parts and accessories are manufactured by divisions of the major automobile manufacturers and by independent parts manufacturers. The independent manufacturers include:

- Original Equipment Manufacturers (OEM) who produce parts for the automobile manufacturers to use in automobile production. The same parts are also supplied for repair and maintenance use after manufacture, generally through the automobile manufacturer.
- Independent Manufacturers normally distribute their production through warehouse distributors and wholesalers. Though some have OEM divisions, they are not usually OEM manufacturers.
- Remanufacturers (Rebuilders) are essentially the same as the independent manufacturer, except that they remanufacture used parts ("cores") to produce a finished product meeting or exceeding the specifications of an equivalent new part.

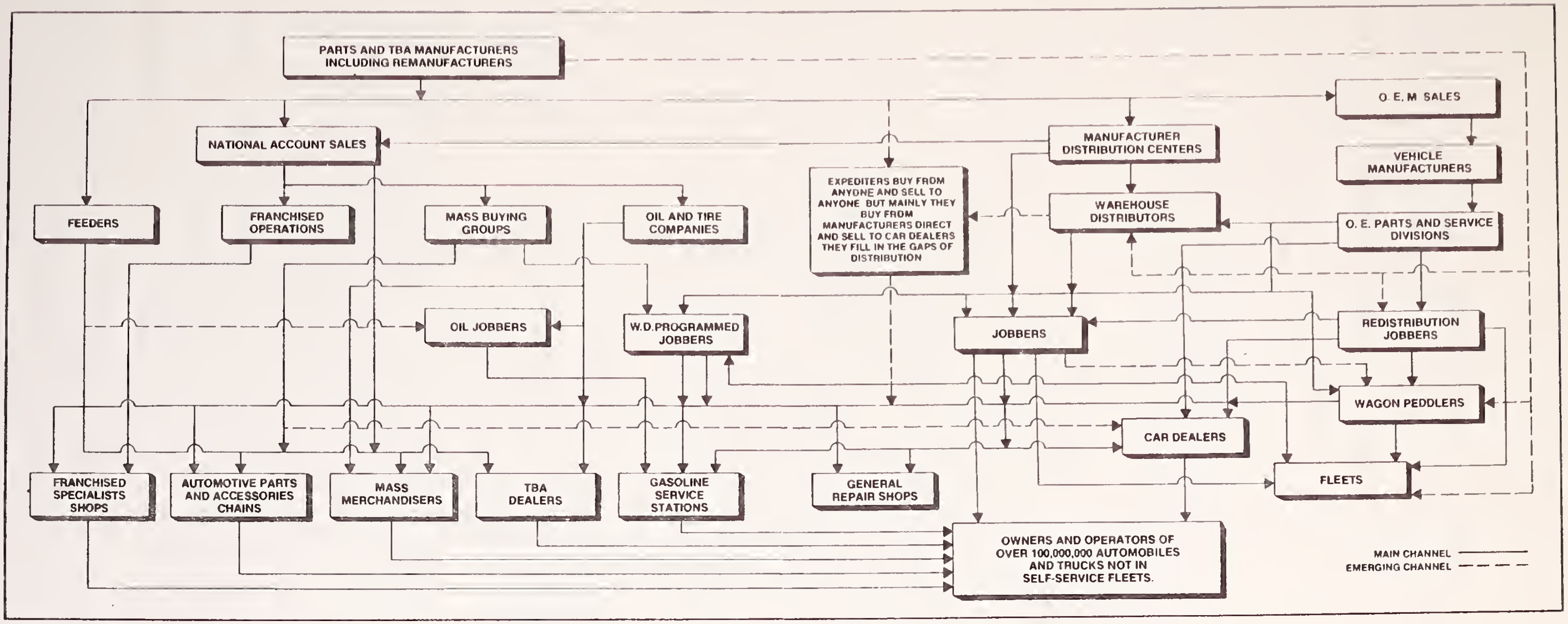
The independent manufacturers may be companies engaged solely in automotive parts production, or may be automotive divisions of companies diversified in other industries.

3.4.1.1 The Distribution Network - Parts manufacturers use a variety of aftermarket distribution channels to reach the end users of their products. Figure 3-4 identifies the complex nature and interdependence of the distribution system for automotive replacement parts, supplies, and accessories.

Although new trends and relationships emerging in parts distribution are making significant changes in the traditional network, three levels of distribution are still central: distributors, jobbers, and repair outlets/retailers. The distinctions between the distribution activities of these three categories are becoming increasingly fine, however, in many cases.

3.4.1.2 Distributors - Distributors are major companies whose inventories are sufficient in quantity and variety to support many large customers on a direct sales basis. They operate strictly as wholesalers, and often serve as a manufacturer's agent in return for special discounts and some degree of exclusive distribution rights. Distributors and their primary customers include:

- Warehouse Distributors, who sell to a variety of independent jobbers.
- Oil and Tire Companies, who sell to their dealers and/or company owned outlets, and to various other retail chains, usually through the parent firm.
- Mass (Cooperative) Buying Groups, who sell to their members (jobbers and/or repair outlets/retailers) and gain the benefit of volume purchasing.
- Franchising Companies, who sell to their franchised speciality repair shops.
- Feeders, who sell to major chain stores and mass merchandisers, to whom they normally provide merchandising support.



Source: Reprinted from Chilton Motor Age, (9th Edition. 1976, by permission of Chilton Book Company, Radnor, PA)

FIGURE 3-4. DISTRIBUTION FLOW OF AUTOMOTIVE REPLACEMENT PARTS, ACCESSORIES, SUPPLIES AND EQUIPMENT

3.4.1.3 Jobbers - Jobbers are smaller firms than distributors, and their inventories are consequently shallower and less varied. They buy from warehouse distributors and/or manufacturers for wholesale and retail resale. Their market orientation is to individual repair outlets, especially independent general garages, gas service stations, and automobile dealers, and to retail "walk-in" trade. Other than the general parts jobber (often known as an auto parts store), this category includes:

- Redistribution Jobbers, who in addition to a general parts stock, also inventory certain product lines in sufficient quantity to supply other jobbers, much as a warehouse distributor does.
- W. D. (Warehouse Distributor) Programmed Jobbers, who are provided with specialized merchandising programs by warehouse distributors. These programs include a variety of promotional techniques and sale aids, and are a response to increasing competitive pressures from high volume chain stores and mass merchandisers.
- Oil Jobbers, who specialize in petroleum products and other items sold by their primary customers, gas service stations.

3.4.1.4 Repair Outlets/Retailers - The third category, repair outlets/retailers, is characterized by its primarily retail orientation and by the high percentage of parts sales made in connection with vehicle maintenance and repairs. The latter characteristic, however, may vary considerably depending on the market orientation of the firms involved.

For example, franchised speciality repair shops, gas service stations, independent general garages, and automobile dealers make mostly service-related parts sales. On the other hand, parts and accessory stores, discount department stores, and the many grocery, drug, and hardware stores with small auto parts departments rely mainly on sale to "do-it-yourselfers". TBA dealers and mass merchandisers (such as Sears, Penney's, Wards) aim at both service-related parts sales and the do-it-yourself market.

The members of this category buy from all the preceding levels: jobbers, distributors, and manufacturers. The level at which purchases are made is essentially volume related. The mass merchandizers and chain stores often buy directly from the manufacturers, while independent repair outlets/ retailers buy primarily through jobbers.

Firms at the retail level also buy and sell from each other on a wholesale basis, though this is usually limited to local businesses. In this respect, new car dealers often function heavily as jobbers, particularly in regard to sheet metal or "crash parts" used in body repairs. Also, new car dealers either inventory of have rapid access to many slow-moving parts not usually stocked by other parts distributors.

3.4.1.5 Expediters and Wagon Peddlers - Filling in the gaps in the distribution process are expediters and wagon peddlers. As noted in Figure 3-4, expediters mainly buy direct from manufacturers and sell to automobile dealers. They take advantage of temporary shortages in fast moving parts resulting from problems in the distribution pipeline and provide an alternative, quick response source for needed items. Wagon peddlers, also called wagon jobbers, provide a regular and personalized service by selling various parts and supplies from route trucks. They generally buy from warehouse distributors, and sell to all repair outlets/retailers.

3.4.1.6 Network Interrelationships - An excellent overview of the pricing policies and discount structures of the various members of the aftermarket parts business is contained in

Volume I of the Arthur D. Little, Inc. study, Data Base Development of Automobile and Light Truck Maintenance, DOT-TSC-NHTSA-78-25, August 1978.

It should be recognized that the repair and maintenance of the United States automotive transportation system encompasses the installation of parts, as well as the performance of labor operations. In this sense, all levels involved in manufacturing and distributing parts have a vital support function: namely, to supply the right part at the right time. This objective of the parts business is not generally recognized by the various segments of the I/M/R industry, who perceive parts essentially as an end product, rather than as a vital portion of a central process. Among many members of the I/M/R trade group, so-called "parts inventory management" systems are often non-existent or are poorly utilized. The unavailability of parts is often the main reason for delays in vehicle repair completion, a major irritation to the consumer. In addition, it has a stong adverse effect on the productivity of the trade group members.

3.4.2 Industry and Market Statistics

As is apparent from Figure 3-4 above, the automotive aftermarket is a complex, highly interwoven network. Further, due to the various legislative, consumer, and marketing trends affecting the I/M/R industry over the past few years, considerable changes in the distribution process have occurred, and continue to occur. In attempting to present a quantitative picture of the aftermarket parts industry, the researcher faces problems similar to those pointed out in Section 3.1.4 above. While an independent in-depth survey was not within the scope of this study, a diligent review of the more readily available data produced a general outline of the industry. In most cases, the figures presented below should be considered as knowledgeable estimates at best.

Because the distinctions between the various types of distributors and jobbers are often vague, most sources consulted group the two together, under the heading "wholesalers". Because of the overwhelming volume, gasoline-related statistics are normally excluded from aftermarket parts reporting. The authors have maintained this convention in the figures below. The figures presented below represents data for 1977 and 1978.

For 1977, estimates of the total number of wholesalers range from 27,000 to 29,000.[2,3,4,5] Of these, 22,000 to 25,000 can be broadly considered jobbers, as opposed to distributors.[4] The majority operate from a single location, with annual sales of less than five million dollars. There are, however, several firms in the $100 to $400 million range, operating from multiple locations.[4] Total number of employees has been approximately 230,000, of which 30,000 were sales personnel.[2,5] Total inventories held by wholesalers are extimated at $2.75 billion.

Sales have been approximately $20 to $21 billion annually, exclusive of tire sales. Tires accounted for another $10-11 billion.[2,3,5,6] Over 60 percent of sales have been to resale customers such as gas service stations, car dealers, independent general garages, and other wholesalers. The remaining 40 percent has been about evenly split between do-it-yourselfers and fleet, government, and industrial users.[2]

To quote one aftermarket authority interviewed, "The number of retail outlets for aftermarket parts is anyone's guess." All of the I/M/R trade group members listed in Section 3.1.4 above engage in retailing automotive parts. To those 248,000 outlets must be added the thousands of grocery, drug, hardware, and discount/variety stores with an automotive parts department. Finally, almost all of the 22,000 to 25,000 jobbers are also involved in retail trade. Estimates of the total number of retail parts outlets range as high as 444,000.[3]

Industry sources generally agree, however, that there are 50,000 to 60,000 retail outlets involved in high volume parts retailing, exclusive of jobbers and I/M/R trade group members whose retail parts sales result primarily from vehicle repairs/maintenance.[7]

For 1978, the range of total retail aftermarket sales has been estimated at between $35 and $40 billion (see Table 3-6), exclusive of TBA and Do-It-Yourself markets. Tire sales have been estimated at $10-11 billion, and D-I-Y sales at $13 to $16 billion. (See Section 3.4.3 below) With miscellaneous other aftermarket sales (such as audio accessories, etc.), the total retail aftermarket in 1978 represented a $63 to $67 billion business.

3.4.3 Industry Trends

Several key trends have emerged in the aftermarket parts industry in recent years. Among the more significant are:

- Do-It-Yourself Repairs - A 1976 survey by the Automotive Parts and Accessories Association estimates that there are over 36 million do-it-yourself (DIY) buyers of automotive parts and accessories, and the number is increasing. The main reasons for the DIY trend are the mechanic shortage, the increasing cost on maintenance and repairs, and the increased interest in self-maintenance of vehicles. Approximately 41 percent of DIY purchases were from discount department stores and mass merchandisers, 14 percent from automotive TBA chains, 29 percent from jobbers, and 16 percent from service stations, car dealers, mail order, etc.[7]

The 1978, Do-It-Yourself market has been estimated at $13 to $16 billion, as mentioned above. The high range of this estimate has been arrived at as follows, using a correction factor of 7.6 percent annually to obtain estimates of 1978 sales:

Sales through Non-Automotive chain store (Drug, Grocery, Hardware, etc. Stores) 1977 Sales: $2 Billion Source: Home & Auto, June 12, 1978, p.23	$2.2 Billion
Sales through Mass Merchandisers (Sears, Penney's, Ward's, Auto-Home-TBA, Discount and Department Stores) 1975 Sales: $6.9 Billion Source: Reference 3	$8.6 Billion
Sales through Parts Wholesalers, Jobbers 1977 Sales: $4.9 Billion Source: Reference 2	$5.3 Billion
Total:	$16.1 Billion

There is undoubtedly some overlap among the above figures and between the above figures and Table 3-6, due to non-standard definitions of industry channels. For this reason the authors have used a range of $13 -16 billion for the do-it-yourself market, based on their best interpretation of the available data.

Quality Emphasis - Both increased government regulation and growing consumerism have created a demand for improved quality in aftermarket parts. The DIY trend is a major factor, as are mass merchandisers' marketing techniques which emphasize lifetime and other long term guarantees.

Increased Inventory Requirements - The massive and continuing changes in the nation's fleet due to fuel conservation, emissions, and safety legislation, and the proliferation of import models is rapidly increasing the total number of different parts needed to maintain the fleet. The accompanying climb in minimum inventory requirements presents a major financial challenge to all levels of the aftermarket parts industry. From a marketing standpoint, this trend favors the non-specialized wholesaler carrying a broad line of parts, and likely already using sophisticated inventory management techniques.

Direct-Buying Retailers - Manufacturers' direct sales to mass merchandisers and to buying groups representing independent retail outlets will continue to increase. As one example of the strength of this trend, consider that 50 percent of consumer battery purchases are made through direct-buying mass merchandisers.[8] It is estimated that 60 percent of mass merchandiser purchases are direct from manufacturers, with only 40 percent through wholesalers.[3]

Jobber Specialization and Diversification - The market pressures resulting from the growth of mass merchandisers and speciality repair shops, backed-up by private brands, manufacturer direct buying, and advanced marketing methods, are eroding the traditional distribution network. Jobbers, in particular, will be strongly affected. In response, they are expected to take one or more of the following avenues:

- change to speciality repair shop support and distribution operations,[3]
- increase "programmed distribution" agreements to gain the marketing support of larger firms,
- add workstalls for the performance of competitive labor operations, utilizing their own inventory.

Some jobbers will, of course, remain traditional, full-line outlets. However, they will utilize sophisticated purchasing and inventory management techniques, and will adopt the advanced marketing methods of the competition and adapt them to their local requirements.[3]

3.4.4 Federal Equipment Standards

Another important aspect of the automotive aftermarket parts business is its impact on the adherence to safety and emissions regulations. It is obvious that both the correct performance of the labor operation and the use of appropriate parts, determine whether or not the vehicle will meet the manufacturers' specifications.

Various safety related parts sold in the aftermarket must be in compliance with the Federal Motor Vehicle Safety Standards, of which there are fifty-one.[55] NHTSA'S Office of Motor Vehicle Safety Compliance enforces the federal equipment standard through a self-certifying statute. This statute makes the manufacturer responsible for certifying that the equipment he produces meet the safety standards where applicable. The DOT does not approve or certify. It sets the standards and has the authority to levy penalties and fines against manufacturers who do not comply with the standard of manufacture. Enforcement consists of surveillance testing of vehicle/ components during manufacture, and of buying and testing vehicles in use from the marketplace. The Office of Motor Vehicle Safety Compliance has forty-three personnel available for investigative duties, and has eighteen testing laboratories throughout the country for verification of compliance by the manufacturers monitored. They also have vehicle/parts recall authority which was provided in the 1974 amendment to the 1966 National Traffic and Motor Vehicle Safety Act.

Most recently, the Environmental Protection Agency (EPA) has proposed regulations which would institute this same type of self-certification program for the aftermarket manufacturers of emission related parts. The manufacturer would certify such parts as being equivalent to the OEM components with respect to their impact on emissions. This can be accomplished in two ways:

- Demonstrate to EPA that their parts do not increase vehicle emissions by proving that the critical performance parameters of the aftermarket emission components are equivalent to those of the OEM parts they replace, or
- Run back-to-back Federal Test Procedure (FTP) emission tests on vehicles equipped with OEM components and with equivalent aftermarket parts to be certified.

Public hearings on the proposed regulations were scheduled for late 1979.

3.5 TRAINING OF AUTOMOTIVE MECHANICS

Repair specialist training activities in the United States can be broadly divided into seven training channels:

- On-the-job training
- Public vocational education
- Private trade and technical schools
- Apprenticeship programs
- Automobile manufacturers' programs
- Oil companies, mass merchandisers, chain store parent companies
- Miscellaneous (equipment and parts manufacturers, military programs, correspondence schools)

A description of each channel is presented below.

3.5.1 On-the-Job Training

On-the-job training (OJT) includes a wide spectrum of training activities, from "hanging out" at local service station to a carefully planned step by step program in a general garage or new car dealership. In rare instances, OJT may even approximate a formal apprenticeship program, especially when combined with a manufacturer's or other's training materials. All mechanics are exposed to this channel to some extent. At one end, it represents the primary training channel for an unknown, but substantial, number of mechanics. At the other, it is means of supplementing knowledge gained through more structured training programs.

OJT is production oriented training, a means of learning trouble-shooting and manipulative skills from more experienced co-workers. It emphasizes the "how-to" of repair work, rather than the "why". OJT meets the continuing education needs of most mechanics. It is common practice, for example, for repair outlets to send only one mechanic to a training program aimed at introducing a new product, skill, or piece of equipment. That mechanic is then used to train his fellow mechanics as necessary.

OJT, by its nature, does not lend itself to detailed qualitative or quantitative evaluation. Nonetheless, as in any field, OJT is vital to productive, efficient performance. Many studies have reported that mechanics consider OJT a very important, if not the most important, method of learning the trade.[9] This is further reflected in the high reliance of the other training channels on "hands-on" training.

3.5.2 Public Vocational Education

This channel is composed of the high schools, community colleges, and other public educational institutions offering mechanic's training. These institutions are typically tax-supported, requiring at most only nominal tuition and fees. By the same token, this channel is open to anyone meeting residency requirements.

The authors located no central body of data on mechanic's vocational education, and believe it unlikely that such data has been compiled.* Therefore, a review of available literature and interviews with industry officials were used to provide a generally indicative overview.

Vocational education (voc-ed) programs, by definition, train for entry into a specific trade or occupation. They are normally broken down into three categories: secondary, post secondary, and adult education.

Secondary voc-ed programs are aimed at high school youth. They normally last two years, and are taught during the eleventh and twelfth grades. Attendance is usually two to four hours per day, five days a week. Due to the maturity level of the students, and the fact that these programs often serve as "dumping grounds" for difficult students, there is considerable doubt as to the number who are actually preparing for an automotive service career, and who ultimately enter the field. Because of the widely varying nature of the secondary programs offered, students can be considered prepared for entry into all phases of the I/M/R industry, but limited most of the time to very basic entry positions.

Post secondary voc-ed programs are aimed at older youth, 18 to 25 years of age. The course of instruction lasts either one year or less, or two years. The one year course, is likely to provide basic entry level training, while the two year course, often culminating in an associate degree, provides a

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*HEW was checked for data on vocational education and was able to provide some limited statistical data which was incorporated into the report. The Department of Labor was not specifically checked; however, HEW, VICA (Vocational and Industrial Clubs of America), and the MVMA Educational Programs Department all replied that they knew of no other sources for a central body of data on mechanics' vocational education. In view of these inputs, no further checks were made, aside from literature searches.

true measure of occupational skill. Attendance at either is normally three hours per day, five days per week. As these students are older and more likely to have made serious career choices, most can be considered to enter some facet of the I/M/R field. They are in much higher demand, especially those who complete an associate degree, and may be oriented towards service management positions as well as mechanic positions. In view of the demand, most can obtain the better paying entry positions, especially in new vehicle dealerships.

Adult voc-ed programs also fall into two categories. The first is aimed at the disadvantaged: the chronically unemployed and minority group members. These programs, which include Federal Job Corps and CETA (Comprehensive Employment Training Act) Skill Centers, typically enroll a student for 35 hours a week, for a maximum of one year. The key purpose of this training is to provide sufficient skill to enable the student to find a job. As such, the orientation tends to be toward basic entry level positions. These programs may also offer an OJT agreement with an employer, with part of the student's wages and basic tool requirements subsidized by the government. The length and structure of these experiences will obviously vary according to the employer and the nature of his business.

The second category of adult voc-ed programs is what is commonly referred to as "night school". The program lasts three hours a night, one day a week, and usually requires one quarter or semester (three to four months) to complete. Students are normally employed persons seeking to upgrade or add to their existing skills, though in some cases, new occupational skills are sought.

Most voc-ed programs are aimed at producing a general or "all around" mechanic, able to work on any part of any automobile. Specialized training in a particular skill area, such as automotive air conditioning or electrical systems, is most often found in adult education night classes, less often in post secondary programs and adult education programs for the disadvantaged, and rarely in secondary programs.

Voc-ed curricula vary greatly, as do numbers of students and facility quality. An official of the Educational Programs department of the Motor Vehcile Manufacturers Association (MVMA) notes that public sector programs range from "hobby shop" in high school to two-year automotive technology associate degrees, and enrollment ranges from two students to one hundred per class.

Facilities and equipment in voc-ed programs are a subject of major concern to industry officials interviewed. Mechanic's training requires expensive and complex equipment, especially in regard to today's sophisticated fuel conservation and emission control systems. Further, this equipment and the vehicles and components necessary for "hands on" training require large workrooms in addition to the standard classroom. Many programs are likely to be limited in their acquisition and updating of facilities and equipment by available funding and revenue sources. One of the hallmarks of an active voc-ed instructor is the ability to obtain donations of equipment and vehicle components from local repair outlets and parts, equipment, and vehicle manufacturers. Industry sources spoke of "ten year old equipment and engines" as norms in voc-ed programs, rather than exceptions.

The quality of voc-ed programs appears to be very uneven, and, unfortunately, get low ratings from service industry personnel more often than not. Though all of the persons interviewed noted that there are many excellent programs, the overall consensus was that most programs need substantial improvement, especially secondary programs.

In a recent issue of a leading trade publication, the editors strongly suggested that employers can only be sure of two things in regard to the average secondary voc-ed graduate: a probable interest in the trade, and the makings of a beginning apprentice.[8] In 1973, a member of a state advisory group for a leading voc-ed student organization reported that many high school automotive classes are "hobby shops" in which the students play around with auto parts and accessories.[10] A spokesman for Automotive Service Councils, Inc. (ASC)*, recently told the authors that voc-ed programs are not producing "useful" entry level mechanics.

The problem seems to stem from three sources:

- lack of a widely accepted and implemented standard curriculum
- instructor quality
- student selection standards

Although industry associations and government agencies have published suggested program standards and course outlines for mechanic's training, there is little evidence that these guidelines are widely used. A thorough 1970 study reported considerable differences among the curricula of over 80 secondary schools surveyed.[9] Of the 40 programs selected as most representative, total hours of instruction ranged from 180 to 2,000. The hours devoted to an individual subject were equally varied, with, for example, electrical systems instruction ranging from 19 hours to 600 hours. There is no reason to believe that much, if any change has occurred since that study.

Even if a thorough curriculum is established, based on suggested standards, the end product still depends greatly on the instructor. One member of the apprenticeship staff at the Department of Labor (DOL) noted in 1978 that, "...anyone who

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* Trade association representing approximately 5,000 independent auto repair firms.

wants to become an apprentice in the automotive service industry is wasting his time by taking the average post secondary adult education class. I don't think the instructor, in most cases, is qualified to impart such knowledge to the individual."[8] Industry officials interviewed seemed particularly concerned that voc-ed instructors may not be up-to-date in their mechanical knowledge, especially in the areas of emissions control and fuel systems. In Standards for Vocational Automotive Service Instruction, MVMA and the American Vocational Association (AVA) recommend that an instructor should ideally be proficient in all NIASE (National Institute for Automotive Service Excellence) test categories, including body and paint work. Minimum requirements should include at least "five years of recent and broad" automotive service experience.[11] Claims have been made that too few auto mechanics teachers have industry backgrounds or can meet NIASE competency tests.[10] The voc-ed instructor occupies a particularly difficult position: not only should his technical background be first-rate, he must also be able to convey this knowledge in an effective manner. As the nature of the program requires extensive "hands on" and "how to" instruction, keeping current requires more than reading trade journals, and thus presents a major problem for the voc-ed instructor during times of rapid product change.

In the vast majority of voc-ed programs, student selection criteria do not exist, and of course, are unlikely to, given the public status of these programs. The courses are open to anyone who wishes to enroll, and particularly at the secondary level, this leads to avocational rather than vocational enrollments. One voc-ed authority quotes surveys showing less than fifteen percent of high school voc-ed students either enter the industry or ever intended to do so.[10] Voc-ed instructors have noticed in recent years a marked deterioration in students' learning skills, particularly reading and mathematics. As a result many have had to lower curriculum standards and increase reliance on instructional techniques, such as visual aids, that bypass these learning blocks.[8] The Industry Planning Council suggests voc-ed advisory committees establish ideal profiles for the automotive service student to assist in evaluating potential students. They nonetheless conclude that, at least on the secondary level, it is not possible to reject students from automotive service voc-ed programs. Their recommendation is to accept as many students as possible, and then concentrate on those students demonstrating strong interest and ability.[11] The MVMA spokesman says, "The quality of the program totally depends on the nature of local involvement.....(there are) many fine programs throughout the country.....It depends on the instructor and support from local (repair outlets)."

The I/M/R industry is involved in upgrading voc-ed programs in several ways. The Industry Planning Council, in addition to sponsoring a detailed new set of standards for voc-ed programs, is actively developing and promoting a voluntary accreditation/national certification program for voc-ed institutions. VICA (Vocational and Industrial Club of America), founded in 1965, is aimed at upgrading voc-ed programs at all levels, and has had some impact at secondary levels. The automobile manufacturers' and importers' training programs are extended to voc-ed intructors wishing to keep up with the latest product developments.

Table 3-14 lists the 1978 enrollments in and completions of voc-ed programs, as well as the breakdowns in secondary, post secondary, and adult education enrollment. Adult education is further broken down into preparatory (job entry) and supplementary (skill improvement) programs, based on 1977 statistics adjusted proportionately to 1978 enrollments.

The points that stand out in Table 3-14 are the high percentage of secondary enrollments and the overall low completion percentage for all programs. If, as suggested, less than fifteen percent of secondary voc-ed students enter the

TABLE 3-14. ENROLLMENT IN AUTO REPAIR VOCATIONAL EDUCATION, 1978 (IN THOUSANDS)

Program	Total	Secondary	Post Secondary	Adult Education		Completions	% Completions
				Preparatory	Supplementary		
Auto Mechanics	338.6	209.3	36.0	37.3	56.0	98.9	29.1
Body & Fender Repair	91.5	49.1	10.0	13.0	19.4	28.8	31.4
Other Automotive	110.0	59.0	6.7	17.7	26.5	26.8	24.3
Totals	540.1	317.4	51.7	68.0	101.9	154.5	28.6
% of Total	100.0	58.8	9.6	12.6	18.9	28.6	

Source: Office of Education, U. S. Department of Health, Education, and Welfare trade, it may be argued that a waste of resources is occuring. However, this is mitigated by the fact that the large majority of voc-ed students who do not enter the trade constitutes a body of customers that are better informed about auto inspection, maintenance and repair.

Secondly, even if it is assumed that all programs last two years, then the annual completion rate should be close to 50 percent. The 28.6 percent reported completion rate indicates the severity of the problem. Since it can be reasonably assumed that post-secondary and adult education completion percentages will be higher than those for secondary completion, the secondary picture takes on an even bleaker look, especially since it represents almost 60 percent of total voc-ed enrollments.

The National Workshop on Accreditation and Vocational Education counted approximately 7,700 voc-ed institutions in 1979, most of which can be expected to provide some form of auto mechanic training.

3.5.3 Private Trade and Technical Schools

This channel is composed of non-public institutions offering automotive service training on a commercial basis, in order to generate a profit. Income is from tuition and fees paid by students, and in many cases, from maintenance and repair work performed by the students as part of the training process. Additionally, many schools are approved for Veterans Administration training and CETA programs, thus deriving income from federal funds. Similar arrangements also exist at some state and local government levels.

Students in this channel are similar in age to those in post secondary voc-ed programs, i.e., 18 to 25 years old. Their selection of a private institution where they must pay directly for their education indicates a definite career commitment, and therefore a high percentage can be expected to enter the mechanic's trade. Graduates of this channel are thus normally in high demand among employers. Although many of the same criticisms directed toward public voc-ed programs and instructors are often aimed at trade schools also, the commitment of this channels' graduates and the firmer academic and practical discipline of its programs count highly with employers.

Because of the competitive environment of this channel and the students' strong work orientation, these institutions typically offer intense practical training, aimed at developing a salable skill in a minimum amount of time. Of the 54 schools with mechanic's programs listed in the National Association of Trade and Technical Schools (NATTS) Directory, the average full-time general mechanic course lasts 36 weeks, though programs ranged from a low of 24 weeks to a high of 94 weeks. Part time programs normally require twice as much time.[12] Full-time attendance normally entails 40 hours per week.

Curricula vary greatly, depending on what the institution finds necessary to maintain its competitive position in the eyes of students and employers. The programs are generally aimed at producing general automotive mechanics. However, of the schools listed in the NATTS Directory, 20 also offered specialized courses in tune-up, air conditioning, etc., and 20 also offered courses in body and paint.

NATTS serves as an accrediting organization for its member schools, including the 54 schools offering mechanic's training. Accreditation in a specific subject area, such as auto repair, is not based on meeting a single uniform standard, but rather on how well the school's program will meet its stated objectives. Outside specialists are used by NATTS to evaluate auto repair programs submitted for accreditation.

NATTS is the sole source of central information that could be located regarding this training channel. The executive director of NATTS estimates that its members graduate approximately 15,000 persons per year from auto mechanic programs, although no actual count is available. He also estimated that there are from 3,000 to 5,000 private trade and technical schools in the United States, of which 535 are NATTS members. He believes that the 10% of NATTS members who offer auto mechanic training is probably representative of all trade and technical schools. NATTS membership does tend, however, to include a disproportionate number of larger schools.

The exact difference in average enrollment size between NATTS members and non-members is unknown; however, according to NATTS, the difference is considerable. For the purposes of this study, the authors estimate that the non-members are half the number of the NATTS members. Based on that assumption, then of the 300 to 500 schools (the 10 percent in the preceding paragraph) estimated to offer auto repair training, 41,700 to 69,500 graduates can be expected. No data is available on either specialized versus general repair training or part-time versus full-time enrollment. Nor is data available regarding placement of the graduates in the I/M/R industry, though it is likely that most graduates do enter some phase of the industry.

3.5.4 Oil Companies, Mass Merchandisers, Chain Store Companies

This channel includes oil companies, department stores such as Sears, Penney's, Ward's, and K-Mart, TBA and auto and home supply chains, and a variety of other discount and chain operations offering maintenance and repair services. As the scope of this survey prevented interviewing or surveying any significant number of these firms, representative companies were interviewed to provide the following information. All parties interviewed requested that their names be kept confidential, basically for competitive reasons.

The training efforts of this channel reflect, in general, the marketing approach of its members. Since most concentrate on a limited number of high volume maintenance and repair services, training is structured accordingly.

Employees are normally selected by the repair outlet manager or owner to be sent to a parent company operated regional training center. One firm reported that employees are tested prior to selection to ensure that they are capable of absorbing the material to be presented. The extent of this practice is unknown. Other selection criteria include length of employment, probability of continued employment, absence of needed skills, and the necessity to meet parent company training requirements.

There is no charge for the training; however, travel and lodging are an expense for the repair outlet in some cases. Further, the repair outlet continues the wages and loses the production of the employee while he is at the training center, a financial loss that can be important to a small establishment such as a service station.

No information is available regarding how many of those trained were already working as mechanics and how many are new entries. Considering the basic nature of the training provided, and the fact that already well-trained employees are not likely to be selected for additional training, it is probable that a high percentage of those trained can be regarded as new entries. Based on the authors' estimates, it will be assumed that 50 percent of those persons completing a training program can be considered new entries into the field.

The training program is normally offered in blocks covering one subject, such as tune-up/emissions or air conditioning. The student attends eight hours per day for three to six days per subject. The entire course of instruction consists of three to six such blocks covering:

- General maintenance
- Tune-up/emission controls/fuel systems
- Air conditioning/accessories
- Suspension/alignment/brakes
- Electrical/electronic systems.

Some specialty and department store chains offer an additional block covering the installation of major accessories such as air conditioners, cruise controls, etc. Students usually attend one block at a time, to minimize work disruption. The entire course of study is normally completed over a one year period.

As with private trade and technical schools, the program blocks feature at least 50 percent "hands on" training, with the remainder devoted to lecture, and in some cases, self-instruction media. The student to instructor ratios reported were excellent, ranging from a low of 6:1 to a high of 15:1, with the average about 12:1.

In addition to training conducted in central and regional facilities, on-site training in repair outlets is utilized to introduce new products, equipment, and repair methods. Other nearby repair outlets belonging to the same chain will often send employees to take advantage of this on-site training. On-site training from "source reps", i.e. field technical representatives of parts suppliers, is also utilized.

All of the firms surveyed relied heavily on follow-up testing to judge the effectiveness of their training programs. Some use their own tests, while other monitor NIASE test results. Comments concerning the usually highly regarded NIASE tests were surprising. While all the firms providing information recommend or require NIASE certification, at least three companies promote NIASE only because of its public recognition value. All three believed NIASE tests to be too easy, and had stiffer testing requirements of their own. One training executive at a national company said, "You can pass NIASE with a 70 percent score. Who wants a 70 percent brake job?" Another noted his firm's disappointment with NIASE, and spoke of plans to back up their own tough tests with a corporate certification program. Yet another company gives its own tests - 40 percent written and 60 percent "hands on" - to compensate for what it considers serious deficiencies in NIASE methods. One firm uses NIASE testing, but requires a 90 percent score on the test (and further reports that its trainees have been averaging 95 percent in recent months).

Most of the major oil companies have strong training programs well underway and growing. Based on the conservative 50 percent assumption noted above, it is estimated that 8,000 to 12,000 new entries completed these training programs in 1978.

During the interviews with oil company training officials, it became evident that mechanic's training programs have been given a higher priority in recent years than in the past. According to one executive, this attention is more than just a marketing ploy or an attempt to capture more of the increasingly lucrative maintenance and repair market. As service stations have become more profitable, station owner turnover has decreased. Today's higher caliber, more stable station owners have more appreciation for the investment in training and in its long term rewards. Further, training of station employees helps reduce the high turnover common to the business. Increased professional pride (and higher wages) resulting from training become a major factor in employee retention.

Of the major department store chains, it appears that only one has a strong program at this time. The programs of the others are either minimal or non-existent. However, they are almost all reportedly working on upgrading or implementing training programs, and announcements of major commitments to training can be expected in the relatively near future. The authors estimate that this channel trained no more than 1,500 new mechanics in 1978, and that figure is likely optimistic.

Little data was obtained on the training programs of the other members at this channel such as auto and home supply stores or TBA dealers. It is estimated that only a very small amount of training is performed by these groups, and this is supported by a report that two of the largest national TBA chains started their first training program in 1978.[13] It is probable that specialty repair chains provide training, but such training would be directed at their specific products, such as mufflers or brake systems, and would, therefore, be very limited in application. Any estimate of the numbers of mechanics trained would be speculation on the part of the authors, and therefore no estimate is made.

3.5.5 Miscellaneous Training Channels

3.5.5.1 Equipment and Parts Manufacturers - Numerous equipment and parts manufacturers (or in some cases, the distributors of their products) offer specialized mechanic's training. A 1977 report listed 19 companies offering such training in the areas of wheel alignment and balancing, brakes, engine performance, and steering and suspension alone.[14]

Equipment companies typically offer free on-site instruction with the purchase of their products. Depending on the complexity of the product, this training ranges from two hours to three days. Additional in-depth training normally assumes that the trainees already possess a fair degree of competence in related skill areas, but nonetheless, in the case of complex equipment such as engine analyzers and dynomometers, training is very detailed and may add significantly to the mechanic's skill and knowledge.

Parts manufacturers normally train in the installation of their products (e.g., sunroofs, rustproofing), servicing their products (e.g., fuel injection systems), or in installing and servicing their products (e.g., air conditioning units). Training parameters are similar to those of the equipment manufacturers. Manufacturers of basic parts, such as brake, suspension, and ignition components may also offer general courses related to their products. For example, courses on engine tune-up and emission controls are available from most of the major ignition parts manufacturers.

No detailed survey of this category was undertaken, because of the high number of firms, the often limited nature of the training provided, and the fact that most trainees are already mechanics.

3.5.5.2 Military Programs - Military auto repair training programs are designed to meet the particular needs of the armed forces, and in most cases do not fit within the parameters of this study. As the U. S. Army operates the largest fleet of vehicles and presumably trains the largest number of mechanics, its programs were examined as being the most representative of the military programs.

Current Army programs that are most applicable to this study cover light wheeled and tracked vehicles. A light vehicle is defined as one weighing less than five tons. The soldiers enrolled in these courses receive an average of nine weeks of training in minor vehicle maintenance, such as lubrication and the removal and replacement of minor parts. No diagnostic training is provided. According to an Army spokesman, the graduates are "apprenticeship ready". Additional OJT is the responsibility of the commanding officer of the unit to which the graduate is assigned. However, this training is directed to the particular vehicles used by that unit, and will not normally provide a significant increase in skill level.

Approximately twenty percent of those taking the first course are later sent to a higher level school, averaging 18 weeks, where diagnosis and major repairs are taught. Since one of the prerequisites for this advanced course is re-enlistment for another term of service, graduates of the second course will represent a higher percentage of career oriented soldiers.

Given the limited training received by the majority of military mechanics, the specialized character of the vehicles* which they are trained to service, and the authority the armed forces have to fill their schools as necessary to meet military I/M/R requirements, military programs can be expected to produce few mechanics who can directly enter civilian I/M/R employment without further training. An Army spokesman estimated that fewer than 3,000 soldiers per year are trained in categories directly applicable to civilian I/M/R work. The authors believe that figure to be optimistic in light of the considerable differences between civilian and military repair operations in terms of vehicles, production requirements and working conditions and procedures. No current data is available on the number of military mechanics who seek similar civilian employment. Considering that almost all enlistments occur among high school age youth, it is likely that many of those receiving military auto repair training have not yet made firm career choices, and may not continue to pursue I/M/R work in civilian life. Because of these uncertainties, no estimate of entries into the civilian I/M/R trade will be made.

3.5.5.3 Correspondence Schools - Correspondence training, in the authors' opinion, plays a very small role in mechanics' training. For that reason, and because the resource limitations of the study prevent more detailed investigation, only general

* It is recognized that some types of military vehicles (staff cars, light trucks and "Jeeps") are virtually identical to their civilian counterparts.

comments are presented regarding this training channel.

Correspondence courses are offered by some automobile manufacturers, by public educational institutions, by private trade and technical schools, and by private firms specializing in correspondence training. In addition to self-instruction courses, some programs are available for use in a group instruction format utilizing a technically advanced instructor such as a repair shop foreman.

Though the quality and scope of such offerings may vary considerably, the courses are typically similar to those used in the classroom portions of the other training channels, and thus range from relatively short programs, covering a specific skill area, to complete general mechanic's training. The programs are normally designed and used in conjunction with some form of OJT or apprenticeship.

Students using this training channel run the gamut from entry level youths to highly experienced mechanics seeking to upgrade specific job skills. A relatively recent development is the proliferation of correspondence courses designed to assist mechanics in passing the NIASE examinations.

Program costs vary considerably, depending on the originating institution or organization, and are typically free or minimal from manufacturers and public educational institutions. When correspondence courses are taken by an I/M/R industry employee, costs are often wholly or partially absorbed by the employer.

3.5.6 Apprenticeship Programs

Apprenticeship programs combine highly structured practical work experience at a repair outlet with instruction in theory at a cooperating vocational education institution. The programs are sponsored by industry associations, such as NADA or ASC, and by unions, such as the International Association of Machinists and Aerospace Workers. Programs are reviewed and approved by the Bureau of Apprenticeship & Training of the Department of Labor, and by the appropriate state agencies.

An apprenticeship agreement is signed by the apprentice and his employer, defining the conditions of the apprenticeship, such as length of the apprenticeship period, skills to be learned, wages, working hours, etc. Three apprenticeship categories are used in the I/M/R industry: general mechanic, body repairman, and painter.

Historically, an apprenticeship lasts four years, with 2,000 hours of work experience to be completed annually. The apprentice works under the supervision of an experienced mechanic, systematically spending a defined number of hours in various repair categories, e.g., 500 hours of brake work, 1,000 hours of transmission work, and so on.

A minimum of 144 hours of related classroom instruction is required annually, usually in the form of night classes at a cooperating educational institution, although approved correspondence courses may be substituted if necessary. The subjects taught include technical theory (synchronized with the work experience) and occupational health and safety. Additional subject matter may include shop practices, union or automotive industry history, customer relations, and mathematics.

Beginning apprentices are normally paid 50 to 55 percent of a journeyman's wage, and are advanced at regular intervals based on the successful completion of each step of the program. By the end of the program the apprentice reaches 95 percent of journeyman's wages. Based on prior experience or rapid progress, an employer often may exceed the amount specified in the apprenticeship agreement.

Apprenticeships are typically limited to persons 18 to 30 years of age, and the majority tend toward the former figure. Prospective apprentices are typically screened carefully for attitude, health, ability to learn, and desire for an automotive service career. A high school diploma (or equivalent) is almost always required. These prerequisites limit this channel to above average entrants, but also help ensure a high rate of program completion and subsequent career loyalty.

Table 3-15 presents 1977 national apprenticeship statistics, the most recent available. The most significant point to be made is the low absolute number of apprentices, especially body repair apprentices. Cancellations, while high at 25 percent, are not as serious as they appear, since most occur during the initial months of the program. Based on a four year program and no growth in total numbers, if all apprentices were to complete their programs, the annual completion rate would be 25 percent. The 1977 completion rate of 16 percent combined with the small growth that has occurred, appears to indicate that at least 64 percent of all apprentices complete their programs.

Table 3-15 also reinforces an ASC spokesman's statement that there is an "enormous void" in the training of body repair mechanics. Apprenticeship programs are particularly appropriate for this type of training. Skilled collision damage repair is close to an art, and requires detailed instruction and OJT from a master body repair mechanic.

Apprenticeship programs are widely considered to produce the best repair specialists of any training channel. Nonetheless, these programs constitute a very minor percentage of today's training activities. Two reasons are frequently cited for this seeming paradox in an industry complaining of a shortage of skilled mechanics:

- The poor image of the I/M/R industry and of the trade limits the number of qualified applicants interested in an auto career.

- The relatively low initial wages combined with the lengthy training period deters potential apprentices

TABLE 3-15. APPRENTICESHIP ENROLLMENT STATISTICS, 1977

Classification	Enrolled Jan. 1977	New Enrollments	Cancelations	Completions	Enrolled Dec. 1977
Automobile and related mechanics	8,224	3,926	2,008	1,425	8,717
Automobile and related body mechanics	1,915	737	541	198	1,913
Totals	10,139	4,663	2,549	1,623	10,630
Percentage of Jan. 1977 enrollment	100.0%	46.0%	25.1%	16.0%	104.8%

Source: Bureau of Apprenticeship & Training, U. S. Department of Labor who can easily find better wages and faster advancement elsewhere.

These two reasons are valid to a certain extent. However, the high secondary voc-ed enrollments, even if avocational in nature, nonetheless indicate a high degree of interest in the I/M/R work. Further, in many parts of the country, especially urban areas, mechanics wages have increased enough in recent years to make even a beginning apprentice's wages attractive in most cases. Employers and potential apprentices do not generally perceive that an apprenticeship period is an extended learning period, similar in some respects to attending college. The emphasis is not on high earnings, but on mastering skills that will permit future financial well-being. In our opinion, the primary reason for the low number of apprentices is the reluctance of employers to embark on the long term commitment required by an apprentice program. The sources of this reluctance are noted below:

- Employers are concerned about the high drop-out rate of apprentice programs.
- Since "raiding" competitors is a common recruitment method in the industry, employers hesitate to invest in apprentices who may leave for another job during or after training.
- Long term planning is a rarity among repair outlet managements; too often it is defined as planning a year ahead. In this context, the idea of a four year program is handicapped from the beginning.
- Many employers believe that competent mechanics can be trained in much less than four years. This belief is especially prevalent in new vehicle dealerships, due to a high degree of job specialization and the concentration on specific product lines.

As a result, employers resist supporting and promoting apprenticeship programs, and make little effort to recruit apprentices. Many potential apprentices are very likely unaware of this training channel as a means of entry into the trade.

In 1977, NADA began a drive to recruit apprentices for its newly developed three year apprentice program. The goal was to attract 13,000 entrants per year for three years. Two years later, despite a major promotional campaign by the concerned NADA staff, the association's 21,000 member dealerships had only 1,500 apprentices. The authors' experience is that most dealers were only vaguely familiar with the program, if they were familiar with it at all; this despite the highly professional NADA promotional effort.

In contrast, ASC's approximately 5,000 members enrolled 1,600 apprentices in little more than a year from the 1978 program introduction. In our opinion, if the reluctance of employers can be overcome, qualified applicants can be attracted to and retained in apprenticeship programs.

The authors believe that, in the end, apprenticeship programs are the only realistic, lasting means of meeting the growing demand for skilled mechanics, though other techniques can assist in softening the effects of the national mechanic shortfall. Modifications to the traditional approach are necessary, however, to increase the utility of apprenticeship programs by adapting them to the specific needs of the various types of repair outlets. Such modifications include shortening the length of the training period (as already accomplished in the NADA program and as successfully demonstrated in Germany) and the development of programs specializing in specific repair and maintenance categories.

Implementing a national apprenticeship drive requires a firm commitment by all members of the I/M/R industry. State and Federal government assistance is needed in promotional, organizational, and financial capacities. Financial assistance includes subsidies and incentives for both employers and apprentices.

3.5.7 Automobile Manufacturers' Programs

The automobile manufacturers occupy a unique position in the training of mechanics, since all training activity revolves directly or indirectly around the vehicles they produce. In addition to providing training for the estimated 235,000 mechanics employed by their franchised dealers, the manufacturers are the source of the product descriptions and technical information on which all other training relies. Therefore, this section will examine the manufacturers' training activities in relation to their affiliated mechanics and in relation to non-affiliated mechanics.

The majority of the material presented is based on interviews with the three major domestic manufacturers and the American subsidiaries of two leading European manufacturers. Collectively the dealers of these five manufacturers employ 91 percent of the mechanics estimated to be working in new vehicle dealerships. Additional interviews were conducted with representatives of the other trade and support group members. All data presented below are 1978 figures.

Manufacturers' training programs are offered free of charge to those participating, whether affiliated or non-affiliated. The employer must bear the associated travel and lodging costs when training is conducted away from the workshop, in addition to losing production while employees are in training. Most employers also continue the employee's normal wages while in training, although some consider that paying travel and lodging expenses is sufficient since the training allows the mechanic to increase his earning potential. One of the

European importers surveyed reimburses its dealers for a portion of their training related expenses. These reimbursements amounted to 17 percent of the total training budget.

Employees are selected for training using essentially the same criteria noted above for oil companies and mass merchandisers, etc. The two European import manufacturers do, however, have carefully defined minimum training requirements that will influence selection to some extent. The domestic manufacturers basically require only that dealers be able to competently repair and maintain the vehicles they sell. As new vehicle dealers employ considerably more mechanics per outlet than do the other trade group members, three additional criteria play an important part in the selection process:

- Which employee can most effectively communicate what he learns to his co-workers?
- Which employee will most effectively grasp the material to be presented?
- Which employee specializes in the subject of a particular training session?

No data are available on the number of existing mechanics trained versus the number of new entries to the trade. As new vehicle dealers typically pay the highest wages of any member of the trade group, they employ a disproportionate number of the more experienced and skilled mechanics. Although entry level training is conducted by the manufacturers, the majority of this channel's activity is aimed at improving and updating existing skills.

The training program employs a block approach, with one to three day courses offered in the basic repair categories. The length of individual training sessions depends, of course, on the complexity of the vehicle systems and components involved. Longer courses may be scheduled for especially complex components, job entry training, and product familiarization training.

The manufacturers' training programs are also unique, of course, in that the majority of the training conducted is product specific. Each manufacturer trains in the repair and maintenance of its own products, as opposed to the other training channels which must consider the products of all manufacturers. Thus a manufacturer's courses may be much shorter than those of other channels, but more effective in relation to its own products.

In addition to their product-specific courses, the manufacturers offer an increasing amount of general repair instruction. This includes both job entry training and advanced theory courses for experienced mechanics. Several manufacturers also conduct NIASE certification preparation programs, including a section on test taking techniques.

The manufacturers surveyed employ the equivalent of 239 full-time instructors, although 319 persons whose primary job function is instructing were reported. One domestic manufacturer uses the equivalent of ten full-time instructors solely for training non-affiliated mechanics. The others made no distinction between instructors training non-affiliated mechanics and those training affiliated mechanics. The instructors are backed-up by 151 various support personnel, including writers, clerks, and program administrators.

In addition to these full time instructors, the manufacturers' field service or technical representatives perform on-site training among their other duties. Their activities account for up to 19 percent of the total training effort, in the case of one import, but the overall average is estimated at five to ten percent. The special value of field force training is the ability to quickly reach dealerships with new, important information, such as solutions for problem components and improved repair procedures. Although this information is incorporated into training sessions and mailed out in the form of technical service bulletins, its immediate, on-site physical demonstration is invaluable. Field representatives also conduct semi-formal or impromptu sessions to fill a dealership's particular need and/or when the subject matter does not justify establishing a formal class.

Training is conducted in 94 regional training centers throughout the country. Two domestic manufacturers also use 104 mobile training vans or trailers to supplement their regional training centers. These mobile units, equipped with repair equipment and vehicle components, are driven or towed directly to dealerships for on-site formal training sessions.

Collectively, in 1978, instructors provided 22,454 training days in regional training centers and 14,684 training days in dealerships or other local facilities, such as motels. These figures do not include the training performed by field technical representatives noted above. Class size in regional training centers ranges from 7.8 to 10.5 students with the average reported being 9.5. Classes held in dealerships average 3.5 to 4 students for the import manufacturers, with their typically smaller dealerships, and 9 students for the domestic manufacturers.

A total of 270,951 work-days of training had been received in 1978 by affiliated mechanics from the five manufacturers interviewed. A detailed breakdown is provided in Table 3-16.

Since course structures vary among the manufacturers, the information received was grouped as required to provide comparable repair training categories. For example, one manufacturer includes fuel systems in its tune-up/emissions class, while another teaches the two areas separately. A third includes electrical/electronic systems with its tune-up/emissions training.

TABLE 3-16. WORK DAYS OF TRAINING RECEIVED BY AFFILIATED MECHANICS FROM AUTOMOBILE MANUFACTURERS* IN 1978

Training Category	Work Days of Training	% of Total Man Days
New Product Orientation General Maintenance	145,367	53.6
Tune-up/Emission Controls Fuel Systems Electronic/Electrical	47,404	17.5
Air Conditioning Accessories	9,328	3.4
Suspension Brakes Steering	16,686	6.2
Gasoline Engine	4,232	1.6
Diesel Engine	9,741	3.6
Transmission Differential	26,701	9.9
Body and Paint Trim and Upholstery	11,492	4.2
Total	270,951	100.0

*Source: Interviews with three major U.S. and two European vehicle manufacturers

Among the manufacturers, some differences in the percentage of training devoted to a particular training category are apparent, but, overall, allowing for the differences in product design and engineering, new model introductions, etc., the information received was remarkably similar. A higher reliance on fuel injection or power brakes, for example, leads to correspondingly greater training emphasis in these categories.

Because of differences in record keeping practices, it was not possible to determine the actual number of mechanics trained by the manufacturers. However, dividing the work days of training received by the number of mechanics employed by the dealers of the manufacturers surveyed shows that the average general mechanic received 1.62 days of training per year, and the average body repair mechanic receives .21 days of training per year. It should be emphasized that this is purely an average. Obviously some mechanics receive considerably more since many courses offered last three or more days. As an example, one of the European manufacturers interviewed offers no course of less than three days. On the other hand, a considerable number of mechanics are not sent by their dealers to any manufacturer's training at all. They do benefit, however, from OJT passed on by their co-workers who have attended training classes. Further, it is a relatively common practice for a key service employee, such as a shop foreman, to hold a class for his co-workers after returning from a training session.

The small amount of training given to body repair mechanics re-emphasizes the problem in this area as noted above, in Section 3.5.6.

Table 3-16 shows only the training received by affiliated repair specialists. In addition, 77,060 work days of training were received by non-affiliated mechanics. In this case, there is a clear difference among the manufacturers surveyed. <u>All</u> of the non-affiliated mechanics were trained by the domestic manufacturers. This training amounted to almost 25 percent of the domestics manufacturers' total training activity. A breakdown of this training by repair category was available only from one manufacturer. Based on this data, the training emphasis is similar to that of affiliated mechanics except for the expected greater concentration on general maintenance, tune-up, air conditioning, etc., which constitute a greater percentage of the non-affiliated mechanics' business.

In addition to providing formal classroom training, the manufacturers also supply a wide variety of self-instruction media for workshop or home study purposes. Over 1.1 million booklets/newsletters/manuals (76 different titles) were distributed in 1978 to affiliated mechanics for self-instruction purposes. This figure does not include basic repair manuals or product/procedure updates. In some cases this self instruction material is mailed directly to the mechanic's home, as often as twice a month. 76,400 video tapes (10 titles) and 8,700 films/filmstrips (31 titles) were also distributed to dealerships to use as in-house training aids. The majority of these visual tools are sound-accompanied, either by record or cassette tape, and are reinforced by printed texts. Instructor's guides are available for conducting group sessions.

The European manufacturers also reported the use of programmed learning texts, supplying 5,200 copies (7 titles) to their dealerships. They are rated as highly effective and of average effectiveness, respectively, by the two manufacturers involved.

Two manufacturers reported distributing a total of 440,000 copies (20 titles) of booklets/manuals/newsletters to non-affiliated mechanics. The others had no statistics available regarding distribution to non-affiliated mechanics, although all except one import manufacturer indicated that their self-instruction materials are readily available to any mechanic.

Considering the many product changes rapidly occurring at this time, information on new vehicle components and systems is of prime concern. The domestic manufacturers offer both training sessions and repair information publications an average of four weeks prior to the introduction of new vehicle systems/ components. One domestic manufacturer reported that 75 percent of its mechanics are trained in new systems/components prior to introduction, while the other two reported that 75 percent are trained within two months after introduction.

The European manufacturers noted similar time frames: new system/component training and repair information publications are available two to three weeks prior to introduction. One manufacturer reported that the majority of its mechanics are trained prior to new system/component introduction. The other trains 50 percent within six months after introduction, and 75 percent within twelve months.

The manufacturers uniformly rated "hands on" training as the most effective training approach. It represents from 25 to 85 percent of their programs, with a weighted average of 53 percent. Lecture and self-instruction are rated as of average effectiveness and represent, respectively, 34 percent and 13 percent of the programs. The manufacturers consider student feedback and follow-up testing the most accurate means of evaluating the effectiveness of their program.

One manufacturer provided complete training cost figures, and one provided the partial costs that could be obtained from its particular accounting system. On the basis of these figures, the cost per work day of training received by a mechanic can be roughly extimated at $113.00 to $143.00. As mechanics received a total of 348,011 work days of training in 1978, total training costs, based on the rough extimate, were $39.3 million to $49.8 million. Training costs for non-affiliated mechanics, using this method, ranged from $8.7 million to $11.3 million, and for affiliated mechanics, from $30.6 million to

$38.7 million. Two manufacturers also provided percentage breakdowns of their training budgets, shown in Table 3-17.

3.5.8 Flow of Repair and Maintenance Information

An excellent overview of the flow of repair and maintenance information is contained in publication DOT HS-803-536, Evaluation of Diagnostic Analysis and Test Equipment for Small Automotive Repair Establishments, July 1978, a report to the Congress by NHTSA, pages 53 to 59. Rather than attempting to duplicate this research, the authors present below some pertinent related data not covered in that report.

To use repair and maintenance information effectively, mechanics must be aware of what information is available. The automobile manufacturers and the three major repair information publishers were interviewed as to the methods they use to make mechanics aware of available repair information publications, and as to the reliability of each method. Tables 3-18 and 3-19 summarize the responses of, respectively, the manufacturers and the publishers.

Next, the same sources were questioned as to their methods of distributing repair information and the effectiveness of each method. Tables 3-20 and 3-21 summarize the responses of, respectively, the manufacturers and the publishers.

TABLE 3-17. TRAINING BUDGET PERCENTAGE BREAKDOWN FOR TWO AUTOMOBILE MANUFACTURERS, 1978

Expense	Manufacturer # 1	Manufacturer # 2
Instructors	35.0%	40.4%
Support Personnel	9.0	25.9
Training Materials and Media	3.0	7.9
Training Publications	3.0	2.2
Promotion and Motivation Programs	6.0	.6
Travel, Lodging, etc.	6.0	3.0
Facilities	19.0	9.4
Equipment	2.0	.5
Other	17.0	10.1
Total	100.0%	100.0%

Source: Interviews with automobile manufacturers

TABLE 3-18. METHODS USED BY MANUFACTURERS TO MAKE MECHANICS AWARE OF AVAILABLE REPAIR INFORMATION PUBLICATIONS, 1978

Awareness Method	Method Used for Affiliated Mechanics	Effectiveness			Method used For Non-Affiliated Mechanics	Effectiveness		
		H*	A	L		H	A	L
Mailings to workshop	4**	2	2		1		1	
Mailings to home	1	1			1		1	
Field representatives	5	4	1		1	1		
Internal press	3	3			2	2		
Trade publications	3	3			3	3		
Conventions, seminars, other meetings	5	4	1		2	2		

* H = High, A = Average, L = Low
** Number of manufacturers using method or giving rating

Source: Interviews with five automobile manufacturers

TABLE 3-19. METHODS BY REPAIR INFORMATION PUBLISHERS TO MAKE MECHANICS AWARE OF AVAILABLE PUBLICATIONS, 1978

Awareness Method	Method Used	Effectiveness *		
		H	A	L
Mailings to workshop	3**	1	1	1
Mailings to home	0			
Trade publications	3		1	2
General circulation publications	1		1	
Salesmen or agents	3	3		
Conventions, meetings	3	1	2	

* H = High, A = Average, L = Low,
** Number of publishers using method of giving rating

Source: Interviews with three publishers

TABLE 3-20. MANUFACTURERS' DISTRIBUTION CHANNELS FOR REPAIR INFORMATION

Distribution Channel	Method Used for Affiliated Mechancis	Effectiveness			Method used For Non-Affiliated Mechanics	Effectiveness		
		H*	A	L		H	A	L
Automatic shipment/ Required purchase	5**	4	1		2	2		
Mail order	2	2			3	2	1	
Field representatives	4	3	1		1	1		
Training hand-outs	5	4	1		3	3		

* H = High, A = Average, L = Low
** Number of manufacturers using method or giving rating

Source: Interviews with five automobile manufacturers

TABLE 3-21. PUBLISHERS' DISTRIBUTION CHANNELS FOR REPAIR INFORMATION

Distribution Channel	Method Used	Effectiveness *		
		H	A	L
Mail order	2**	1		1
Salesmen or agents	3	3		
Wholesalers or retailers	0			

* H = High, A = Average, L = Low
** Number of publishers using method or giving rating

Source: Interviews with three publishers

The three major repair information publishers also provided the following data:

The major source of the repair information used to produce their publications is the automobile manufacturers' repair publications. Two of the publishers estimated that 90 percent of their information was obtained from this source, and the third estimated 95 percent. All three noted that the remaining information was obtained in equal proportions from their own research and from feedback from mechanics.

Preliminary repair and maintenance information regarding new models/components is received from the manufacturers four to twelve weeks prior to model/component introduction. Complete data is not usually available until introduction, however. (On one recently introduced model range, though, complete data was provided by the manufacturer ninety days before introduction.) The publication of comprehensive service manuals and parts guides normally occurs eight weeks after the manufacturers' annual new model introductions. On-going product changes, new repair and maintenance procedures, part numbers and price changes are published in monthly bulletins and magazines thirty to sixty days after this information is received from the manufacturer.

The three publishers reported that the domestic manufacturers are, overall, the most cooperative in supplying repair information, with a good to excellent rating in this respect. The Japanese manufacturers' cooperation is rated good, and the European manufacturers' cooperation, acceptable. Two of the publishers added that foreign manufacturers, especially the small Europeans, are hampered by complex communication channels and by translation requirements, and that otherwise their cooperation would have been rated higher.

An ASC spokesman was interviewed regarding the flow of information from the manufacturers to independent mechanics.

In the last two years, the manufacturers in general have become very cooperative in supplying timely repair information and technical service bulletins, although some need to speed the transmission of field solutions to difficult/unusual product malfunctions was noted.

The major problem facing independent mechanics is distributing the repair information received from the manufacturers. It is difficult, not to mention costly, to pass on the information received to hundreds of thousands of independent mechanics. The material must be edited and tailored to fit the resources available to the average independent repair outlet. Further, it must be sorted and distributed according to application, e.g., transmission information to transmission specialists, emissions data to tune-up shops, etc.

Currently, technical service bulletins are checked and sorted as well as possible, and the most important are sent to trade publications serving independent mechanics. ASC estimates that a thorough technical bulletin distribution program for the 220,000 to 250,000 independents who could use such a program would cost $500,000 per year. Through its National Automotive Technical Education Foundation, ASC has sought assistance in establishing such a program from several federal agencies, including DOT, EPA, DOL, and HEW.

3.5.9 Effect of Licensing/Certification on I/M/R Trade Entries

Universal mandatory licensing or certification of mechanics has been proposed as a means of assuring the competence of repair and maintenance work. Such licensing/certification might also have an effect on the entry of new mechanics into the I/M/R indsutry. To evaluate these possible effects, the assumption must be made that licensing/certification standards would be uniform nationwide. Two scenarios can then be constructed based on the severity of these standards.

In the first scenario, the standards are rather easily met, and serve only to weed out the obviously incompetent. While overall entry into the trade may be somewhat reduced by such standards, the entry of bona-fide mechanics will neither be encouraged not discouraged.

In the second scenario, the standards are of sufficiently high level to ensure that only the truly competent will be licensed or certified. In this case, new entries will be discouraged on a short term basis. The eventual impact, however, will be to encourage entry into the trade, because of an increase in the professional status and prestige of the trade, supported by improved financial incentives.

As meeting strong licensing standards requires equally strong training programs, the question of mechanics' licensing is obviously interrelated with the quality of the entire I/M/R training effort. The answer, thus, is not mechanics' licensing, but the development and support of uniform, strong training and apprenticeship programs required for entry into the trade. All those who successfully complete such programs would be, in effect, licensed to practice.

The requirements of certifying a vehicle's compliance with safety, emissions, noise, and fuel economy regulations have currently placed a degree of legal responsibility on mechanics. Though the extent of this responsibility varies by jurisdiction and by the specific regulation, the trend is unquestionably toward a greater and more consistent degree of legal responsibility. Many state and local governments have adopted some form of mechanic's licensing or qualifying to ensure competence in vehicle certification. Mechanics who illegally or incompetently certify vehicles are subject to warnings, fines, and license revocation, among other penalties. In addition to state and local regulations, Federal regulations have placed increased responsibility on the mechanic regarding emissions control repair and tampering.

In this light, licensing mechanics to perform selected certification and compliance activities must be regarded as a positive factor for both the public and the mechanic. This type of selective licensing protects the consumer's investment in a vehicle that meets socially desireable goals and ensures that the thrust of responsible regulation is maintained. Further, mechanics are made specifically aware of their legal responsibilities and are prevented from incurring liability until they are deemed competent to perform certification and compliance activities.

In terms of the effect of selective licensing on entries into the I/M/R trade, the two scenarios noted above continue to be applicable, as does the need for uniform and strong training to support the licensing procedure.

3.6 ROLE OF FEDERAL AND STATE AGENCIES IN MOTOR VEHICLE INSPECTION, REPAIR AND MAINTENANCE

3.6.1 Periodic Motor Vehicle Inspection (PMVI)

In 1966 the National Traffic and Motor Vehicle Safety Act was passed, creating the concept of a state-wide Periodic Motor Vehicle Inspection (PMVI) system. Based on this act the National Highway Traffic Safety Administration introduced PMVI as a national standard in June of 1967. The legislation required that vehicle inspection be a part of the highway safety program and empowered NHTSA to levy sanctions against those states that did not comply with PMVI. These sanction are as follows:[15]

- loss of the state(s) apportionment of Federal highway safety funds
- loss of 10 percent of the state(s) apportionment of Federal highway construction funds.

The states were required to implement PMVI, or show reasonable progress towards implementation by December 31, 1969. A temporary waiver condition was also recognized, after which a state could obtain a permanent waiver or amendment to the standard, on approval by NHTSA.

The Motor Vehicle Safety Act also required NHTSA to develop standards and procedures for state inspectors to use in detecting vehicle defects. These were due in September of 1968; however, they were not released by NHTSA until September of 1973. These standards were known as the vehicle in-use (VIU) standards, developed for vehicles of less than 10,000 pounds gross vehicle weight rating (GVWR).[17]

Table 3-22 shows the extent to which the states are currently involved in PMVI and the numerous standards used for vehicle safety inspection.

Twenty six states and the District of Columbia have laws which require PMVI. Another eight states utilize a form of random spot inspection, and six states have limited inspection laws. Ten states have no laws that require vehicle inspection. Six states have repealed PMVI laws in the last 3 years, (see Figure 3-5.) Of those PMVI inspection systems in operation, only Delaware, New Jersey and the District of Columbia have state or district owned inspection stations. South Carolina may in certain cases allow the Highway Department to maintain state owned stations, and Florida gives counties the option of operating their own inspection stations. All other states have a city, county, or state appointed agent (authorized private garages) system.[16] The map, Figure 3-5, shows the States and territories which require PMVI and those that do not. It also identifies the twelve states which have conducted approved trial substitute inspection programs in recent years.

Due to the various delays and impasses that have developed between the states and NHTSA since 1973, full implementation of PMVI has not yet been achieved. The effectiveness

TABLE 3.22. AUTOMOTIVE EQUIPMENT REQUIRING JURISDICTIONAL APPROVAL

AAMVA—MEMBER JURISDICTIONS	A ALABAMA	B ALASKA	C ARIZONA	D ARKANSAS	E CALIFORNIA	F COLORADO	G CONNECTICUT	H DELAWARE	I DISTRICT OF COLUMBIA	J FLORIDA	K GEORGIA	L HAWAII	M IDAHO	N ILLINOIS	O INDIANA	P IOWA	Q KANSAS	R KENTUCKY	S LOUISIANA	T MAINE	U MARYLAND	V MASSACHUSETTS	W MICHIGAN	X MINNESOTA	Y MISSISSIPPI	Z MISSOURI	AA MONTANA	AB NEBRASKA	AC NEVADA	AD NEW HAMPSHIRE	AE NEW JERSEY	AF NEW MEXICO	AG NEW YORK	AH NORTH CAROLINA
	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
A LIGHTING EQUIPMENT																																		
1 Backup Lamps	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	
2 Clearance Lamps	•		•	•		•		•	•	•		•	•	•		•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•
3 Cornering Lamps			•		X			•	•	•		•							•		•							•		•	•		•	
4 Hazard Warning Light Switches	•		•					•	•	•		•	•			•		•	•		•			•	•						•		•	
5 Hazard Warning Signal Flashers				•				•	•	•						•	•	•	•		•										•		•	
6 Hazard Warning-Turn Signal Flashers				•				•	•	•						•	•	•	•		•					•					•		•	
7 Headlamps—Sealed Beam	•		•	•		•	•	•	•	•		•	•			•	•	•	•	•	•	•		•	•	•		•		•	•	•	•	•
8 Headlamp Housings—Sealed Beam	•		•	•		•	•	•	•	•		•	•			•	•	•	•	•		•		•	•					•	•	•	•	•
9 Headlamp Aiming Equipment				•	X							•							•		•			•							•			
10 Identification Lamps	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•			•	•			•		•	•	•	•	
11 License Plate Lamps	•		•	•		•		•	•	•		•				•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•	•
12 Parking Lamps (Front Position Lamps)	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	
13 Replacement Lenses										•						•		•	•	•											•		•	
14 Reflex Reflectors	•		•	•		•	•	•	•	•		•	•	•		•	•		•	•	•	•		•	•		•	•		•	•	•	•	•
15 Running Lamps					X																													
16 Side Marker Lamps	•		•	•		•		•	•	•		•	•	•		•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•
17 Side Turn Signal Lamps					X																													
18 Stop Signal Lamps	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•	•
19 Tail Lamps (Rear Position Lamps)	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•	•		•	•	•	•	•		•	•	•	•	•
20 Turn Signal Flashers						•		•	•	•			•			•		•	•		•			•							•		•	
21 Turn Signal Lamps	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	•
22 Turn Signal Switches—Class A	•		•	•		•	•	•	•	•			•			•	•	•	•	•	•			•	•	•				•	•	•	•	•
23 Turn Signal Switches—Class B	•		•	•		•		•	•	•			•			•			•	•	•			•	•	•				•	•	•	•	•
24 Triangle Warning Device Kit	•		•	•		•	•	•		•		•	•		•	•	•	•	•		•		•	•	•		•	•		•	•		•	•
25																																		
26																																		
B AUXILIARY LIGHTING EQUIPMENT																																		
27 Auxiliary Low Beam Lamps (Passing)					X					•		•												•							•			
28 Driving Lamps	•		•	•	X	•		•	•	•		•	•			•	•		•	•	•			R	•	•	•	•		•	R	•	•	•
29 Fog Lamps	•		•	•	X	•		•	•	•		•	•			•	•		•	•	•			•	•	•	•	•		•	•	•	•	•
30 Fog Tail Lamps					X																													
31 Off-Highway Lamps					X																													
32 Spot Lamps	•		•	•		•		•	•	•		•	•			•	•	•	•	•	•			•		•	•	•		•	•	•		•
33 High Mounted Stop and Turn Signal Lamps					X																													
34																																		
C SPECIAL VEHICLE EQUIPMENT																																		
35 Warning Lamps for Emergency Vehicles	•		•		X	•		•	•	•		•				•	•	•	•	•	•			•			•	•	•	•	•	•		•
36 360 Degree Emergency Warning Lamps	•		•		X	•		•	•	•		•				•	•		•		•			•				•		•	•	•		•
37 Gaseous Discharge Warning Lamps	•		•		X	•		•	•	•		•				•	•		•		•			•				•		•	•			
38 Headlamp Flashing Systems					X																													
39 Sirens	•		•	•	X				•	•						•	•	•	•		•			•	•		•		•	•	•	•		•
40 School Bus Alternating Warning Lamps	•		•	•		•	•	•	•	•	•	•	•			•	•	•	•	•	•			•	•	•	•	•		•	•	•	•	
41 School Bus Alternating Warning Lamp Flasher		•						•	•		•		•			•	•	•	•		•					•					•			
42 School Bus Stop Arm																																		

AAMVA—MEMBER JURISDICTIONS	AI NORTH DAKOTA	AJ OHIO	AK OKLAHOMA	AL OREGON	AM PENNSYLVANIA	AN PUERTO RICO	AO RHODE ISLAND	AP SOUTH CAROLINA	AQ SOUTH DAKOTA	AR TENNESSEE	AS TEXAS	AT UTAH	AU VERMONT	AV VIRGINIA	AW WASHINGTON	AX WEST VIRGINIA	AY WISCONSIN	AZ WYOMING	BA	BB ALBERTA	BC BRITISH COLUMBIA	BD MANITOBA	BE NEW BRUNSWICK	BF NOVA SCOTIA	BG ONTARIO	BH PRINCE EDWARD I.	BI QUEBEC	BJ SASKATCHEWAN	BK NEWFOUNDLAND	BL
	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•		•	•	•	•		•		•	•		
A LIGHTING EQUIPMENT																														
1 Backup Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•			•	•	•		•	•			•	
2 Clearance Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•	•		•		•	•	
3 Cornering Lamps			•	•			•	•	•		•		•	X	•										•	•				
4 Hazard Warning Light Switches	•			•			•	•			•		•	X	•							•				•			•	
5 Hazard Warning Signal Flashers		•		•			•	•	•		•				•			•				•				•			•	
6 Hazard Warning-Turn Signal Flashers		•		•			•	•	•		•				•			•		•		•				•			•	
7 Headlamps—Sealed Beam	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•	•	•	•	•	•	•			•	
8 Headlamp Housings—Sealed Beam	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•					•		•	•			•	
9 Headlamp Aiming Equipment							•				•		•	X	•											•			•	
10 Identification Lamps	•	•	•	•			•	•	•		•	•	•	X	•	•		•				•	•			•		•	•	
11 License Plate Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•	•		•		•	•	
12 Parking Lamps (Front Position Lamps)	•	•	•	•			•	•	•		•	•	•	X	•	•		•		•		•	•	•		•			•	
13 Replacement Lenses	•						•		•						•					•						•			•	
14 Reflex Reflectors	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•		•	•			•	
15 Running Lamps																														
16 Side Marker Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•			•		•	•	
17 Side Turn Signal Lamps																														
18 Stop Signal Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•	•		•			•	
19 Tail Lamps (Rear Position Lamps)	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•		•	•	•		•		•	•	
20 Turn Signal Flashers				•			•	•	•		•	•			•			•				•				•			•	
21 Turn Signal Lamps	•		•	•			•	•	•	•	•	•	•	X	•	•		•		•	•	•	•	•		•	•	•	•	
22 Turn Signal Switches—Class A	•		•	•			•		•	•	•	•	•	X	•	•		•		•						•	•		•	
23 Turn Signal Switches—Class B	•		•	•			•		•	•	•	•	•	X	•	•		•		•						•	•		•	
24 Triangle Warning Device Kit	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•			•		•					
25																														
26																														
B AUXILIARY LIGHTING EQUIPMENT																														
27 Auxiliary Low Beam Lamps (Passing)	•	•					•		•		•			X	•						•		•		•	•			•	
28 Driving Lamps	•	•	•	•	R		•	•	•	•	•	•	•	X	•	•		•		•	•		•	•	•	•		•	•	
29 Fog Lamps	•	•	•	•	•		•	•	•	•	•	•	•	X	•	•		•		•	•		•	•	•	•			•	
30 Fog Tail Lamps																														
31 Off-Highway Lamps																														
32 Spot Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•			•		•	•	•	•	•	•	•		•	•	
33 High Mounted Stop and Turn Signal Lamps																														
34																														
C SPECIAL VEHICLE EQUIPMENT																														
35 Warning Lamps for Emergency Vehicles	•		•	•	•		•	•	•		•	•	•	X	•			•		•						•		•	•	
36 360 Degree Emergency Warning Lamps	•		•	•	•		•	•	•	•	•	•	•	X	•	•		•		•	•		•			•			•	
37 Gaseous Discharge Warning Lamps			•	•	•		•				•	•	•	X	•			•							•					
38 Headlamp Flashing Systems																														
39 Sirens	•	•	•	•	•			•		•				X	•	•		•		•								•		
40 School Bus Alternating Warning Lamps	•	•	•	•			•	•	•	•	•	•	•	X	•	•		•		•	•			•		•		•	•	
41 School Bus Alternating Warning Lamp Flasher		•					•	•	•		•				•			•		•						•		•	•	
42 School Bus Stop Arm																														

	REGULATORY STANDARDS						
AAMVA—MEMBER JURISDICTIONS	U.S. FEDERAL STANDARDS	SAE STANDARDS	U.S. STATE REGULATORY STANDARDS	CANADIAN FEDERAL STANDARDS	CSA STANDARDS	CSA/ECE STANDARDS	
A LIGHTING EQUIPMENT							A
1 Backup Lamps	108	J-593c		108	D-106.1		1
2 Clearance Lamps	108	J-592e		108	D-106.1		2
3 Cornering Lamps		J-852b			D-106.1		3
4 Hazard Warning Light Switches	108	J-910		108	D-106.1		4
5 Hazard Warning Signal Flashers	108	J-945		108	D-106.1		5
6 Hazard Warning-Turn Signal Flashers	108	J-590b, 945		108	D-106.1		6
7 Headlamps—Sealed Beam	108	J-580b		108	D-106.1	D-106.2	7
8 Headlamp Housings—Sealed Beam	108	J-579c		108	D-106.1	D-106.2	8
9 Headlamp Aiming Equipment		J-602c			D-106.1		9
10 Identification Lamps	108	J-592e		108	D-106.1		10
11 License Plate Lamps	108	J-587d		108	D-106.1		11
12 Parking Lamps (Front Position Lamps)	108	J-222		108	D-106.1		12
13 Replacement Lenses	108	J-576c		108	D-106.1		13
14 Reflex Reflectors	108	J-594e		108	D-106.1		14
15 Running Lamps			CAC-13.17				15
16 Side Marker Lamps	108	J-592e		108	D-106.1		16
17 Side Turn Signal Lamps			CAC-13.18				17
18 Stop Signal Lamps	108	J-586c		108	D-106.1		18
19 Tail Lamps (Rear Position Lamps)	108	J-585d		108	D-106.1		19
20 Turn Signal Flashers	108	J-590b		108	D-106.1		20
21 Turn Signal Lamps	108	J-588e		108	D-106.1		21
22 Turn Signal Switches—Class A	108	J-589		108	D-106.1		22
23 Turn Signal Switches—Class B	108	J-589		108	D-106.1		23
24 Triangle Warning Device Kit	125	J-774c					24
25							25
26							26
B AUXILIARY LIGHTING EQUIPMENT							B
27 Auxiliary Low Beam Lamps (Passing)		J-582a			D-106.1		27
28 Driving Lamps		J-581			D-106.1	D-106.2	28
29 Fog Lamps		J-583c			D-106.1	D-106.2	29
30 Fog Tail Lamps			CAC-13.3				30
31 Off-Highway Lamps			CAC-13.2				31
32 Spot Lamps		J-591b			D-106.1	D-106.2	32
33 High Mounted Stop and Turn Signal Lamps							33
34							34
C SPECIAL VEHICLE EQUIPMENT							C
35 Warning Lamps for Emergency Vehicles		J-595b	CAC-13.21		D-106.1		35
36 360 Degree Emergency Warning Lamps		J-845			D-106.1		36
37 Gaseous Discharge Warning Lamps			CAC-13.21				37
38 Headlamp Flashing Systems			CAC-13.12				38
39 Sirens			CAC-13.8				39
40 School Bus Alternating Warning Lamps	108	J-887			D-106.1		40
41 School Bus Alternating Warning Lamp Flasher	108	J-945			D-106.1		41
42 School Bus Stop Arm		J-1133					42

Revised 3-1-79

X = [illegible] applicable state agency for approval
R = [illegible] sale or use

Source: Reprinted from chart AAMVA, Form # EA-7, March 1, 1979, by Permission of the American Association of Motor Vehicle Administrators.

TABLE 3-22. AUTOMOTIVE EQUIPMENT REQUIRING JURISDICTIONAL APPROVAL (Cont.)

AAMVA—MEMBER JURISDICTIONS	A ALABAMA	B ALASKA	C ARIZONA	D ARKANSAS	E CALIFORNIA	F COLORADO	G CONNECTICUT	H DELAWARE	I DISTRICT OF COLUMBIA	J FLORIDA	K GEORGIA	L HAWAII	M IDAHO	N ILLINOIS	O INDIANA	P IOWA	Q KANSAS	R KENTUCKY	S LOUISIANA	T MAINE	U MARYLAND	V MASSACHUSETTS	W MICHIGAN	X MINNESOTA	Y MISSISSIPPI	Z MISSOURI	AA MONTANA	AB NEBRASKA	AC NEVADA	AD NEW HAMPSHIRE	AE NEW JERSEY	AF NEW MEXICO
	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
D MOTORCYCLE—BICYCLE EQUIPMENT																																
43 Headlamp Assembly—Motorcycle								●	●	●						●	●	●	●	●	●	●		●		●	●			●	●	
44 Headlamp Assembly—Motor Driven Cycle								●	●	●						●	●	●	●	●	●	●		●		●	●			●	●	
45 Headlamp Modulator—Motorcycle																																
46 Windscreens			●																●										●		●	●
47 Face Shields		●						●	●	●	●	●		●			●	●	●		●								●		●	●
48 Goggles		●	●	●		●	●	●	●	●	●	●		●	●		●	●	●		●								●	●	●	●
49 Helmets	●	●	●	●				●	●	●	●	●	●		●		●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
50 Reflex Reflectors—Bicycles			●		X	●		●	●					●		●		●	●	●	●			●			●				●	
51 Reflex Reflectors—Pedal			●		X	●		●	●					●				●	●	●	●						●				●	
52 Reflex Reflectors—Tire					X																											
53 Turn Signal Lamps—Motorcycle	●		●	●		●		●	●	●		●	●			●	●	●	●	●	●			●	●	●	●	●		●	●	●
54																																
E SPECIAL LIGHTING EQUIPMENT																																
55 Deceleration Indicator Lamps					X					●			●							R						●					R	
56 Colored Bulbs					X																											
57 Diffused Non-glaring Lamps					X																											
58 Headlamp Beam Switching Devices																																
59 Headlamp Beam Switching Devices—Semi-automatic																																
60 Ornamental Lamps					X																											
61 Reserve Lighting and Outage Indicators					X																											
62																																
F SAFETY EQUIPMENT																																
63 Air Conditioning Units							●		●				●		●		●		●		●											
64 Antifreeze and Summer Coolant					X	X					X						X	X			●	X		X				X	X			
65 Backup Alarms		●		●															●													
66 Brake Fluids	X	●	●		X	X		●	●	X	X	●		●			●	●	●	●	●			X			●			●	●	
67 Brake Hose—Air																●		●	●	●											●	
68 Brake Hose—Hydraulic																●		●	●	●											●	
69 Brake Hose—Vacuum																●		●	●	●											●	
70 Brake Linings																		●	●		●	●									●	
71 Child Seating Systems																					●										●	
72 Load Binders					X																						●					
73 Mirrors—Exterior			●														●		●		●						●			●		
74 Safety Glass	●		●	●		●	●	●	●	●		●	●	●		●	●	●	●	●	●			●	●	●		●		●	●	
75 Safety Glazing Materials			●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●		●	●		●	●	●
76 Seat Belts	●	●		●			●	●	●			●		●	●	●	●	●	●	●	●		●		●	●	●	●		●	●	
77 Tire Chains					X																						●					
78 Trailer Hitches																●	●				●			●							●	
79																																
80																																

AAMVA—MEMBER JURISDICTIONS	AG NEW YORK	AH NORTH CAROLINA	AI NORTH DAKOTA	AJ OHIO	AK OKLAHOMA	AL OREGON	AM PENNSYLVANIA	AN PUERTO RICO	AO RHODE ISLAND	AP SOUTH CAROLINA	AQ SOUTH DAKOTA	AR TENNESSEE	AS TEXAS	AT UTAH	AU VERMONT	AV VIRGINIA	AW WASHINGTON	AX WEST VIRGINIA	AY WISCONSIN	AZ WYOMING	BA	BB ALBERTA	BC BRITISH COLUMBIA	BD MANITOBA	BE NEW BRUNSWICK	BF NOVA SCOTIA	BG ONTARIO	BH PRINCE EDWARD I.	BI QUEBEC	BJ SASKATCHEWAN	BK NEWFOUNDLAND	BL	U.S. FEDERAL STANDARDS	SAE STANDARDS	U.S. STATE REGULATORY STANDARDS	CANADIAN FEDERAL STANDARDS	CSA STANDARDS	CSA ECE STANDARDS
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●		●	●	●	●		●		●	●								
D MOTORCYCLE—BICYCLE EQUIPMENT																																						
43 Headlamp Assembly—Motorcycle	●		●	●	●	●			●	●	●	●	●		●	X	●					●	●		●		●	●		●	●		108	J-584			D-106 1	D-106 2
44 Headlamp Assembly—Motor Driven Cycle	●		●	●	●	●			●	●	●	●	●		●	X	●					●	●		●		●	●		●	●		108	J-584			D-106 1	D-106 2
45 Headlamp Modulator—Motorcycle		●																																	NC-20-130			
46 Windscreens	●		●	●	●				●	●	●	●				X	●																205		Z26.1		D-263	
47 Face Shields	●			●	●		●		●	●	●	●				X	●													●					VESC-8			
48 Goggles	●			●	●		●		●	●	●	●		●		X	●													●					VESC-8			
49 Helmets	●	●	●	●	●	●			●	●	●	●	●	●	●	X	●	●	●	●		●	●		●	●		●	●	●	●		218		Z90 1/1971		D-230	
50 Reflex Reflectors—Bicycles	●		●	●	●				●			●	●	●		X	●			●		●	●	●	●		●								NY CPSC		D-113 1	
51 Reflex Reflectors—Pedal	●			●	●				●			●	●	●		X	●			●		●	●	●											NY CPSC		D-113 1	
52 Reflex Reflectors—Tire	●								●								●					●													NY CPSC		D-113 1	
53 Turn Signal Lamps—Motorcycle	●	●	●		●	●			●	●	●	●	●	●	●	X	●	●		●		●	●	●	●	●		●	●	●	●		108	J-588e				
54																																						
E SPECIAL LIGHTING EQUIPMENT																																						
55 Deceleration Indicator Lamps																	●						●												WS DAL			
56 Colored Bulbs																																			CAC-13/4			
57 Diffused Non-glaring Lamps																																			CAC-13/6			
58 Headlamp Beam Switching Devices																																	108	J-564a				
59 Headlamp Beam Switching Devices—Semi-automatic																																	108	J-565b	CAC-13/10			
60 Ornamental Lamps																																			CAC-13/6			
61 Reserve Lighting and Outage Indicators																																			CAC-13/16			
62																																						
F SAFETY EQUIPMENT																																						
63 Air Conditioning Units			●		●								●	●		X	●																	J-639				
64 Antifreeze and Summer Coolant			X		X						X		X				X		X	X															ASTM			
65 Backup Alarms	●						●		●	●																								J-994				
66 Brake Fluids		●	X	●	X	●			●	●	●	●	●		●	X	X					●				●	●	●	●	●	●		116			116	D-265	
67 Brake Hose—Air			●	●							●						●											●					106					
68 Brake Hose—Hydraulic			●	●							●						●							●				●					106			106		
69 Brake Hose—Vacuum			●	●							●						●											●					106					
70 Brake Linings	●	●	●	●			●		●	●	●						●																		VESC-3			
71 Child Seating Systems											●					X						●		●									213					
72 Load Binders																	●								●	●							BMC	393.102				
73 Mirrors—Exterior		●								●	●											●				●							111			111A		
74 Safety Glass	●	●	●	●	●	●			●	●	●	●	●	●	●	X	●	●				●			●	●	●	●			●		205		Z26.1	205		
75 Safety Glazing Materials	●	●	●	●	●	●			●	●	●	●	●	●	●	X	●	●		●		●		●				●			●		205		Z26.1	205		
76 Seat Belts	●	●	●		●	●			●		●	●		●	●	X	●	●				●		●						●	●		209			209	D-159 1	
77 Tire Chains																	●																		NACM-9/72 (TC)			
78 Trailer Hitches	●					●	●				●						●	●				●				●									VESC-5		D-264	
79																																						
80																																						

AAMVA Form # EA

Revised 3-1-79

X Apply directly to applicable state agency for approval
R Prohibited sale or use

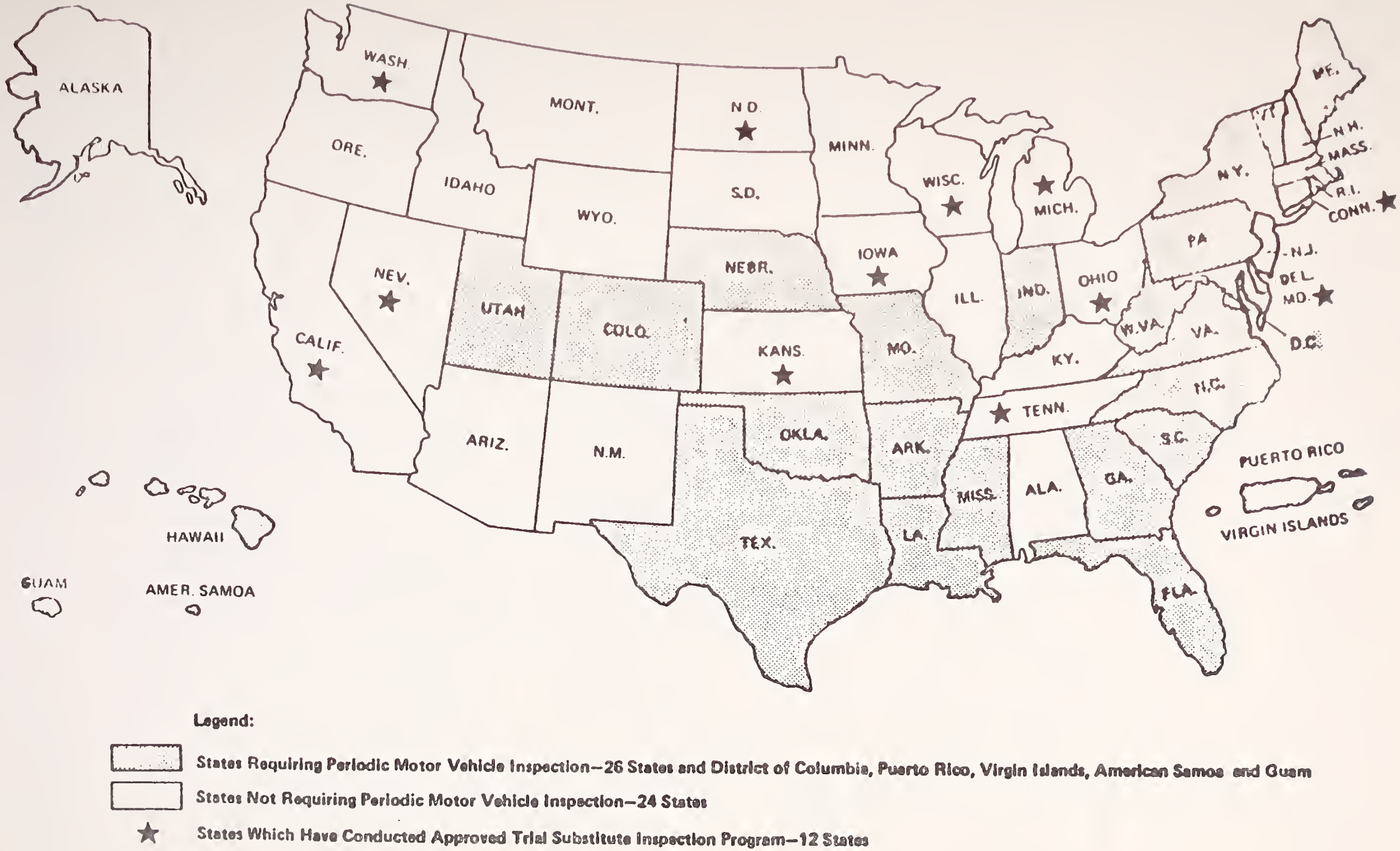

FIGURE 3-5. NATIONAL STATUS OF PERIODIC MOTOR VEHICLE INSPECTION PROGRAM (AS OF JULY 1, 1979)

and the future of the state PMVI system has been the subject of a report to Congress by the Comptroller-General of the United States in December 1977.[17]

Today in the United States, the motorist is subjected to a variety of vehicle inspections based on various Federal or local standards, depending on which state or jurisdiction he resides in. Inspection criteria and operating standards vary significantly, as does the methodology applied. Inspector and technician qualifications are not uniform from one state/jurisdiction to another. Enforcement guidelines and authority provided to the administrating agency are different from one part of the country to another. The official fee for inspection is not uniform; if a state PMVI system requires component disassembly, such as the removal of a wheel or brake drum, the owner is sometimes charged an additional amount.

Tables 3-23 through 3-25 provide an analysis of the various PMVI inspection standards adopted, inspection methodology employed, means of certification used, as well as inspection statistics and other data relative to industry performance, inspection integrity, and consumer/motorist satisfaction/protection.

Under existing program constraints* it was possible to study nine representative states (out of 26) which have instituted PMVI, as listed in Table 3-23. This represents 35 percent of the total number of states and the District of Columbia that have laws requiring PMVI of vehicles. Attempts were made to select states in diverse geographical areas with varying vehicle populations. The states selected were representative of the major approaches being used to implement PMVI. All data in Table 3-23 is based on information supplied by the respective states.

* Imposed by the Office of Management and Budget.

TABLE 3-23. ANALYSIS OF INSPECTION STANDARDS, COSTS, INSPECTION TIME, AND MEANS OF IDENTIFYING VEHICLES MEETING COMPLIANCE

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virginia
Pass/Fail standards used for Safety inspection	State Standards and Regu-lations	MVMA, DOT SAE & State Standards	MVMA	State Standards & Regu-lations	DOT & SAE	MVMA DOT SAE	MVMA, DOT SAE & USASI	MVMA, DOT SAE & USASI	MVMA, DOT SAE, USASI State Re-gulations Standards
Length of time required for Vehicle safety inspection	30 minutes	30 minutes	25 minutes	6 to 7 minutes	45 minutes	60 minutes	30 minutes	20 minutes	20 minutes
Consumer cost of Safety inspection	$5.50	$2.50 to $4.50	$3.00	$2.50	$7.00 to $10.00	$4.00	$5.25	$3.50	$4.00
Means of identifying vehicles Successfully passing Inspection	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker	Wind-shield Sticker

MVMA : Motor Vehicles Manufacturers Association
DOT : Department of Transportation
SAE : Society of Automotive Engineering
USASI: United States of America Standards Institute

Of the nine states studied, three use those standards adopted by the Motor Vehicle Manufacturers Association (MVMA), the Department of Transportation (DOT), the Society of Automotive Engineers (SAE), and the United States of America Standards Institute (USASI). Two additional states use all of the standards mentioned above, except the USASI standards. Two states use standards adopted by state regulation which effectively encompass MVMA, DOT, SAE, and USASI. Maine uses the MVMA standard solely and Pennsylvania uses the DOT and SAE standards. It is common nationwide for those states involved in PMVI, or a form of it, to use various standards of associations (such as SAE), DOT standards or any combination of the preceding.

Sophisticated test equipment has extensive bearing on the speed with which an inspection can be accomplished, as demonstrated in the New Jersey program. The price for inspection varies from $2.50 to $10.00; however, only one state indicated the program was not self-supporting. Windshield stickers are used by all states surveyed to identify vehicles that have passed inspection.

Safety inspection utilizes a combination of techniques to verify the function and condition of system of sub-system/components. Visual inspection is used to verify such items as as light operation, tire condition, etc.; manual techniques are used to verify such items as window regulator operation, brake pedal free play, firmness of pedal, steering wheel play, etc.; and test equipment is normally used to verify wheel alignment, headlight alignment, braking distance/pull, etc.

In the latter category, test equipment varies from inexpensive scuff gauges to dynamic devices for checking wheel alignment. We did not request the states to identify the model and type of equipment used.

Vehicle licensing/identification and ownership data obtained during the safety inspection is shown in Table 3-24.

Verification of the status of the vehicle owners driver's license is made in three of the nine states surveyed. Eight states verified vehicle license plate/tab validity, and two states checked engine serial numbers. Indiana verifies engine serial numbers on motorcycles only. The vehicle serial (VIN) number was checked by all states, and the vehicle registration card was verified by all but one of those surveyed. Evidence of current insurance coverage on the motor vehicle being inspected was checked in two of the states. Verifying insurance coverage is generally aimed at:

- establishing financial responsibility in the event of accident
- deterring unsafe vehicle operation and condition.

Table 3-25 reflects data on inspection statistics, and Table 3-26 presents data on station and technician licensing requirements.

Of the nine states studied, six have current data on the number of vehicles passing the initial (first) inspection. The percentage of vehicles passing the first retest (after initial inspection, failure, and subsequent repair) was available in three states. Six states had data on vehicle owner satisfaction with the inspection system, averaging 72.7 percent satisfaction. Three did not have figures on the percentage of satisfaction. All states except Utah felt government appointed authorized private inspection stations were satisfying the legal requirements of their safety inspection program. Three states provided data on the percentage of vehicles repaired by licensed/certified technicians that passed the first reinspection.

As Table 3-25 indicates, the information received regarding the quality and effectiveness of PMVI Programs is

TABLE 3-24. VERIFICATION OF VEHICLE OWNERSHIP, FINANCIAL RESPONSIBILITY, REGISTRATION AND DRIVER'S LICENSE DATA

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virgina
Inspection of Driver's Lincense & Validity	No	No	No	Yes	Yes	No	Yes	No	No
Evidence of Insurance	No	No	No	Yes	No	No	Yes	No	No
License Plate/Tab	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Engine Serial Number	No	Yes	Yes	No	No	No	Yes	No	No
Vehicle I. D./VIN Number	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Registration Card	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No

*Verification of engine serial numbers in motorcycles only.

TABLE 3-25. PMVI VEHICLE INSPECTION STATISTICS (1978)

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virgina
Number of Vehicles Registered in State/ Jurisdiction	2.3 mil. (approx.)	4.0 mil. (approx.)	497,000	4,781,222	7,254,893	600,000	900,000 (approx.)	425,000	3.5 mil.
Number of Vehicles Requiring Safety Inspection	2.3 mil. (approx.)	3.8 mil. (approx.)	* 1,334,000 (approx.)	4,752,910	8,000,000 (approx.)	490,000 (approx.)	825,000 (approx.)	325,000	7.0 mil. (approx.)
Percentage of Vehicles Passing Initial Inspection	Unknown	Unknown	97% (estimate)	56%	Unknown	52.7%	89.7%	45%	75%
Percentage of Vehicles Passing First Re-Test After Initial Failure & Subsequent Repair	Unknown	98%	Unknown	Not Available	Unknown	47.28%	100%	Unknown	Unknown
Percentage of Vehicle Owners Satisfied With the Integrity of PMVI Repair	99% (estimate)	70%	83%	84%	10%	Unknown	Unknown	90%	Majority
Are Industry PMVI Stations Satisfying the Legal Requirements of the PMVI Program?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
What Percentage of Vehicles Repaired by Licensed Tech-nicians, Pass Inspection After the First Re-test?	Unknown	98%	Unknown	Not Available	Not Available	47.28%	100%	Unknown	Unknown

*Maine and Virginia require inspection at six-month intervals, twice a year.

TABLE 3-26. PMVI INSPECTION STATION AND TECHNICIAN LICENSING REQUIREMENTS

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virginia
STATION LICENSE REQUIREMENTS Requirement to be licensed	Yes	Yes	Yes	Yes*	No	Yes	Yes	Yes	Yes
Cost of license	Free	$30.00	$4.00	$10.00	N/A	$25.00	Free	Free	Free
Term of license	**	**	2 years	1 year	N/A	1 year	**	**	**
TECHNICIAN LICENSING REQUIREMENTS Requirement to be licensed	Yes	Yes	Yes	No	Yes***	Yes	Yes	Yes	Yes
Cost of license	Free	$10.00	$1.00	N/A	Free	Free	Free	Free	Free
Term of license	**	**	5 years	N/A	**	**	3 years	**	**
Written exam requirements	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Provisions for a hands-on examination	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes

* For New Jersey, appointed safety re-inspection stations only. ** Valid until revoked, suspended or surrendered.
*** Pennsylvania has technicians certified, not licehsed

rather limited and should be considered as subjective interpretations of the persons interviewed.

The majority of states license safety inspection stations and technicians as a means of enforcing compliance with inspection standards and, secondarily, to ascertain their competence to inspect. Table 3-26 provides an analysis of station and technician licensing requirements.

Eight of the nine states surveyed require repair facility licensing. Four charge an administrative fee for this licensing, four charge nothing. Three specify the term of license while the other five states license for an indefinite term.

Technician licensing/certification is required in eight of the nine states. Two states charge an administrative fee and six states charge nothing. Two states specify a term of license (3 and 5 years) and the other six states license/certify for an indefinite term. Six states make provision for administering a hands-on examination of the technicians, and two do not.

State legislation regarding PMVI typically empowers the Director of the Department to establish an administrative fee not to exceed a specific amount without further approval of the legislature. Application of this fee depends on funding requirements and the program operation philosophy.

As noted in Table 3-26, five of the nine states studied license inspection stations for an indefinite period of time, and six license technicians for an indefinite period of time. This would appear to contradict the rationale behind licensing, i.e., to enforce knowledgeable inspection. In light of the rapid technological changes occurring in today's motor vehicles, indefinite licensing is no guarantee of continued competence, and hence must be considered of limited value.

Vehicles failing PMVI inspection are generally repaired by licensed industry service personnel. Statistics regarding consumer complaints about such repairs by major categories have been studied in the states concerned and are compiled in Table 3-27.

Of the nine states studied, only four had data on the incidence on incompetence, unnecessary repair and overcharging. Two states had statistics on allegations of fraud. Due to the variances in methodology used by the states to gather, compile, and report this information, no specific conclusions can be drawn without further study.

PMVI could serve as a major vehicle for assessing repair and maintenance practices throughout the country, given a uniform inspection system and a standardized reporting system. This would provide a massive, geographically diverse data base, invaluable for determining the impact of present and planned programs.

The enforcement data for the nine states studied has been compiled in Table 3-28 which shows the number of safety inspection stations, the enforcement agency, the personnel involved, and their technical qualifications.

All states studied provided data on the number of licensed safety inspection stations, as well as the number of enforcement personnel. Of the nine states surveyed, six inspect licensed stations on a regular basis. The number of inspections per-year ranges from two to a minimum of twelve.

State Police administer the program in five states, the Department of Motor Vehicles in three states, and the Department of Transportation in one state. Four states indicated their enforcement personnel possesed strong technical backgrounds, three indicated their personnel did not possess strong technical backgrounds, and two states did not provide an answer to the question.

TABLE 3-27. CATEGORIES OF CONSUMER ALLEGATIONS OR COMPLAINTS REGARDING REPAIRS PERFORMED ON PMVI FAILED VEHICLES

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virginia
Percentage of Repairs Alleging Incompetence	unknown	10%	1%	not appli-caple (N/A)	unknown	unknown	15%	unknown	unknown
Percentage of Repairs Alleged as unnecessary	50%	10%	1%	N/A	unknown	unknown	38%	unknown	unknown
Percentage of Repairs Alleging overcharging	unknown	5%	1%	N/A	unknown	unknown	7%	unknown	unknown
Percentage of Repairs Alleging Fraud	unknown	unknown	0	N/A	unknown	unknown	10%	unknown	unknown
Other	too small to estimate	unknown	unknown	N/A	unknown	unknown	unknown	too small to estimate	unknown

TABLE 3-28. PMVI ENFORCEMENT STATISTICS

	Colorado	Indiana	Maine	New Jersey	Penn-sylvania	Rhode Island	Utah	Vermont	Virginia
ENFORCEMENT STATION Number of Safety (PMVI) Inspection Stations	4,142	5,812	1,638	4,800	18,164	884	1,800	975	3,240
Number of Enforcement Personnel Inspection PMVI Stations	30	25	9	50	69	30	7	8	1,000
Number of Inspections a PMVI Station receives per Year by the Regulatory Authority	3	not provided	2 to 5	3 to 4	not provided	12	not provided	3	12 minimum
ENFORCEMENT PERSONNEL Use of State Police Personnel	No	Yes	Yes	No	Yes	No	Yes	No	Yes
Use of Department of Motor Vehicles Personnel	Yes	No	No	Yes	No	No	No	Yes	No
Use of Department Transportation Personnel	No	No	No	No	No	Yes	No	No	No
Do Enforcement Personnel possess strong technical background?	No	Yes	Yes	Yes	not provided	Yes	No	not provided	No

The number of inspections a PMVI station receives annually would indicate, to a degree, the amount of interface or interaction between the governing entity and industry-operated inspection stations, which in turn may have a direct bearing on performance. In our opinion the technical expertise of enforcement personnel is critical to meaningful performance of the inspection program, as knowledge of the profession or trade monitored is vital to accomplishing program goals and objectives. It is also valuable as a tool in the arbitration of consumer complaints, where judgements made are based on technical, as well as legal considerations.

3.6.2 Inspection Maintenance (I/M)

In 1970, amendments to the Clean Air Act of 1963 mandated that vehicles manufactured in 1975 achieve an emissions reduction of 90 percent as compared to 1970 vehicle emissions levels, and required states to submit to the Environmental Protection Agency (EPA) their State Implementation Plans (SIP) for maintaining ambient air quality. As a result of this legislation, voluntary state Inspection Maintenance (I/M), began as early as 1972 (New Jersey). In 1975, a further tightening of vehicle emissions standards was effected.[18]

The Clean Air Act Amendments of 1977 introduced the National Ambient Air Quality Standards (NAAQS). The standards addressed areas throughout the United States that had ambient air quality problems due to tranportation-related pollutants. Those areas were identified as "nonattainment" areas and 104 such areas were identified by EPA.

To combat the ambient air quality problem and meet the NAAQS, the states with non-attainment areas were required to submit to the EPA revisions to their SIPs no later than January 1, 1979. These revised SIPs had to provide for attainment and maintenance of their ambient air quality no later than December 31, 1982. If attainment of standards for oxidants and CO could not be achieved by 1982, then a specific schedule for the implementation of I/M was to be submitted with their SIP revision, due January 1, 1979. An extension of the attainment date to December 31, 1987 could be granted by EPA.[18]

The Federal Motor Vehicle Control Program (FMVCP) monitors the automobile manufacturer to ensure that production vehicles will meet applicable emission standards throughout their useful life, given proper maintenance and use. The program consists of the following:

- certification of all vehicle prototypes to insure new vehicle standards are met
- random testing of production vehicles at the assembly line
- recall of vehicles when a model line is found to have significant emission-related defects in use.[14]

The Inspection Maintenance (I/M) intent is to augment the FMVCP by providing a means to ensure that reasonable maintenance is performed by the vehicle owner(s) on all vehicles affected by FMVCP and other vehicles in-use (VIU).

The following list identifies the twenty nine contiguous states and jurisdictions where an I/M system is in use in at least one metropolitan area. In the asterisked states I/M programs have been implemented to some degree. Not all require <u>periodic</u> inspection, and some (as in the case of Chicago) are voluntary rather than mandatory programs. Approximately twenty of the twenty nine states have enabling legislation for I/M. EPA is reviewing their SIPs and is in the midst of the rulemaking process and of determining acceptance.

*Arizona
*California
Colorado
Connecticut
Delaware
District of Columbia
Georgia
*Illinois
Indiana
Kentucky
Maryland
Massachusetts
Michigan
Missouri
*Nevada
*New Jersey
New Mexico
New York
North Carolina
*Ohio
*Oregon
Pennsylvania
Tennessee
Texas
Utah
Virginia
Washington
Wisconsin
*Rhode Island

The EPA estimates a minimum 20 percent to 30 percent in pollutants if the I/M program is <u>operated properly</u>. The state of Arizona reports a daily total reduction of 250+ tons of HC, CO, Nox and particulates. New Jersey estimates a drop in CO levels of 20 percent. Cincinnati, Ohio reports approximately a 500 ton total reduction on HC, CO, Nox and particulates daily. The remaining states surveyed are still in initial phases of program operation, and significant data on actual pollutant reduction is not yet available.

The I/M program, like the PMVI program, has also experienced some set-backs. Due to high concern with program costs and public acceptance, several states have altered their enabling legislation, thus delaying the implementation process. State legislatures are carefully weighing public response to voluntary I/M before implementing mandatory I/M.

This study covers the six states and two cities that have implemented effective I/M programs, as listed below (and asterisked above).**

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* I/M Programs have been implemented in these states to some degree.

**The selection of this number of jurisdictions for study was also based on survey-related constrains imposed by the Office of Management and Budget.

Arizona	-	Counties of Maricopa and Pima
California	-	Counties of Los Angeles, Orange, San Bernardino, Riverside, Ventura and Santa Barbara
Illinois	-	City of Chicago
Nevada	-	Counties of Clark and Wahoe
New Jersey	-	Statewide
Ohio	-	City of Cincinnati
Oregon	-	Metropolitan Portland and urbanized areas of Washington, Clackamas and Multnomah counties
Rhode Island	-	Statewide

Tables 3-29 through 3-32 highlight the approaches to I/M inspection used by the states/jurisdictions surveyed. Some of the data requested was unavailable. As in the case of the PMVI, our investigative emphasis will be on the inspection approach, methodology, enforcement, etc.

Table 3-29 identifies the various inspection approaches, licensing/certification requirements, inspection and repair guidelines for private garages and consumer.

Of the eight states/jurisdictions surveyed, all use the idle-mode test. Two are conducted at State inspection stations by a private contractor to the State, four are conducted by State/City inspection stations, and two are conducted by privately owned service stations/garages. Although inspection pass/fail is determined by the idle test, Arizona also conducts loaded-mode tests to develop additional data useful for diagnosis. In October 1979 the California Air Resources Board proposed to delete underhood inspection and rely on optimized loaded-mode emissions inspection.

The Arizona inspection form includes a summary of eleven repair requirements. Eight repair/replacement actions are to be performed only if necessary following preliminary checks.

TABLE 3-29. I/M INSPECTION APPROACHES: LICENSING REQUIREMENTS AND PROGRAM SATISFACTION

	Arizona*	California*	Illinois*	Nevada*	New Jersey	Ohio*	Oregon*	Rhode Island
Idle mode test conducted at State Inspection Stations by private Contractor to the State	Yes	Yes	No	No	No	No	No	No++
Idle mode test conducted at State/City Inspection Stations	No	No	Yes	No	Yes	Yes	Yes	No
Idle mode test conducted at Privately owned service stations and garages	No	No	No	Yes	No	No	No	Yes
Licensing requirement for private garages	No	No	No	Yes	Yes**	No	No	Yes
Qualification/Certification requirement for private garages	No	No+	No	No	No	No	No	No
Licensing of technicians required	No	No	No	Yes	No	No	No	Yes

* Selected counties/cities, see page 3-130.

** New Jersey licenses private garages for re-inspection only. They can repair failed vehicles and then certify that the vehicle meets compliance.

*** If no response to this question was provided, we made the assumption the information was unknown or unavailable.

\+ California requires adjustment and repair stations to meet Class 'A' smog station requirements.

++ Rhode Island uses their one state inspection facility as a referee station.

TABLE 3-29. I/M INSPECTION APPROACHES; LICENSING REQUIREMENTS AND PROGRAM SATISFACTION (CONT.)

	Arizona *	Cali-fornia *	Illinois *	Nevada *	New Jersey	Ohio *	Oregon *	Rhode Island
Inspection & repair guide-lines for private garages provided	No	Yes	No	Yes	Yes	No	No	Yes
Qualifying of technicians required	No	Yes	No	No	No	No	No	No
Percentage of consumer satisfaction with industry's adjustment repair effort	unknown ***	too new to pro-vide data	not avail-able	not avail-able	unknown	unknown	unknown	unknown

* Selected counties/cities, see page 3-130.

** New Jersey licenses private garages for re-inspection only. They can repair failed vehicles and then certify that the vehicle meets compliance.

*** If no response to this question was provided, we made the assumption the information was unknown or unavailable.

\+ California requires adjustment and repair stations to meet Class 'A' smog station requirements.

++ Rhode Island uses their one state inspection facility as a referee station.

In addition, Arizona often provides motorist counseling concerning probable repair requirements.

Three states require licensing of the private garage conducting the emission test (New Jersey private garages do re-inspection only), while the other five programs do not require licensing. Two states require technician licensing and one state requires that the technicians meet certain qualification criteria. Four states out of the eight surveyed provide inspection and repair guidelines to the private garages performing emissions repair on failed vehicles. Of the states surveyed, one state indicated their program is still too new to provide data on the percentage of consumer satisfaction with the repair industry's adjustment and repair efforts. The other seven states indicated the data was unknown or not available.

Licensing, certification, or otherwise qualifying of I/M stations and technicians is as critical as noted above for PMVI licensing. Automotive technology in the last five years has undergone great change in emission systems design and the rate of change is accelerating. To quote NHTSAs National Traffic Safety Newsletter, "In the emissions area, there are complex EGR systems, catalytic converters, fuel injection developments, electronic ignition and microprocessors."[20] Of the programs studied none required renewal of licensing/certification or qualification on a regular basis. Since licensing is only as good as the criteria for the license, present programs that determine competency only at the time of initial licensing make no provisions for verifying that I/M technicians keep abreast of the changing state of the art. In our opinion, verification of technician competency must occur at intervals of no more than two years if I/M objectives are to be achieved and maintained.

The purpose of I/M according to EPA is to, "check pollutant emission levels of motor vehicles with respect to certain emission standards and to adjust to those standards, or below, the vehicles which fail."[19] I/M also supplements FMVCP in assuring that vehicles in-use are maintained in line with FMVCP requirements. In order to meet the intent of I/M and to augment FMVCP, repair and adjustment guidelines are a necessity for those technicians performing such emission-related functions. Further I/M repair and adjustment guidelines based on a "least cost" approach appear to provide a high degree of consumer protection against unnecessary repair and overcharging. Absence of repair and adjustment guidelines may place I/M programs in the position of providing opportunity for the unscrupulous or incompetent repairman. Lastly, repair and adjustment guidelines provide enforcement authorities with solid grounds for mediating disputes.

Table 3-30 depicts the scope of the I/M program for the eight jurisdictions studied.

The Emission Control System Performance Warranty contained in the Clean Air Act of 1970 provided a 24 month/24,000 mile warranty on emission control components to motorists in jurisdictions having an I/M program, except that catalytic converters, thermal reactors, and other components specifically installed for the purpose of reducing emissions are warranted over the useful life of the vehicle, defined as the first 5 years or 50,000 miles, whichever comes first.[15] In California, a 5 year/50,000 mile warranty an all emission control components is provided, as specified in the Health and Safety Code, section 43204.

Public hearings have recently been held by EPA regarding its proposal to require auto makers to warrant the performance, not just the correct manufacture, of their vehicles anti-pollution equipment and any other parts of the vehicle that affect tail pipe emissions. Under this proposal, owners of 1980 and later model vehicles that fail the suggested test would be

TABLE 3-30. SCOPE AND COMPOSITION OF THE I/M INSPECTION PROGRAM

	Arizona*	California*	Illinois	Nevada*	New Jersey	Ohio*	Oregon*	Rhode Island
Visual Inspection under Vehicle Hood	No	Yes***	Yes***	Yes	No	No	Yes	No
Functional Check of Emission Control Components/Systems	No	Yes**	No	Yes	No	No	No	No
Measurement of Vehicle Emissions through Tail Pipe	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Emission Evaluation at idle and at 2250/2500 RPMs	No	Yes	Yes	Yes	No	No	Yes	Yes
Emissions Evaluation at idle only	Yes	No	No	No	Yes	Yes	No	No
Emissions Analysis & Adjusting vehicle to Manufacturers Specifications: Idle RPM, Dwell, Timing	No	No	No	Yes	No	No	No	No

*Selected counties/cities, see page 3-1[illegible].
**In the I/M program in the South Coast Air Basin of California, only the EGR function is checked visually with a mirror. A visual check is also made for catalystic converter, fuel neck restrictor, and gas cap compliance.
***Includes visual inspection of tail pipe and muffler integrity

covered by the warranty during the first 5 years or 50,000 miles, whichever comes first.

Much of the effect of the above activity is and will be negated by the lack of a functional check of emissions control components. Six of the eight programs studied make <u>no</u> provision for functional inspection. In our opinion a functional check is necessary for the following reasons:

- the stringency factors or "cut points" used for idle mode emissions checks will not, in the majority of cases, detect the malfunctioning of basic crankcase control systems, exhaust control systems/NOx control systems, or catalytic converters/thermal reactors. These undetected malfunctions have a direct effect on ambient air quality and maintenance of the same
- a functional check is necessary to identify and thwart tampering with emission control components/sytems
- if malfunctions are not detected during the period of emissions control warranty, the vehicle owner loses the opportunity to excercise that warranty.

It is recognized that stringency factors or "cut points" must be set at levels that will both catch the gross emitters and aid in public acceptance of the I/M program. However, inspection measures (functional checks) that will detect tampering must be implemented to safeguard the nation's investment in emissions control equipment. Although the Federal Government and many states have adopted legislation prohibiting tampering, EPA says "these laws are virtually ineffective in most situations, since the existence of a strong deterent to tampering does not exist---the performance of a tampering inspection as part of an I/M program could represent a suitable deterent to tampering since there exists the threat of not meeting the I/M emission standards."[19]

Table 3-31 illustrates the types of basic equipment used in existing I/M/ inspection stations, and Table 3-32 shows the equipment required by members of the trade group in performing adjustments and repairs on vehicles that failed I/M.

All of the states/jurisdictions inspection programs surveyed use HC-CO infrared analyzers to measure emissions. In addition, California uses a computer controlled emission measurement system coupled with the idle-mode test approach. Arizona uses a dynamometer, (capable of running tests in loaded-mode) but runs its emission test in idle-mode. Arizona reportedly has an Analyzer Certification Program which publishes a list of approved analyzers. A repair facility which purchases an analyzer from this list and registers with the State is entitled to a "free" calibration service, conducted at approximately 90-day intervals. Nevada also uses an oscilloscope and both Nevada and Rhode Island use timing lights, dwell meters, and tachometers in their testing regime.

In the programs of four states (see p.3-127 for the jurisdictions involved), the use of HC-CO analyzers by private garages in performing adjustments and repairs on vehicles that failed I/M is required. Two of these states require also other essential equipment to perform such adjustments and repairs. One of the programs studied required the private garages to calibrate their HC-CO analyzers and specified the calibration intervals.

Emissions tune-up is an exacting procedure, much more so than the "seat of the pants" performance tune-ups of years gone by. Without basic diagnostic and test equipment, and an ongoing requirement to verify and calibrate analyzers at established maximum intervals, it is not likely that automobile owners affected by I/M may be subjected to the following:

TABLE 3-31. I/M EQUIPMENT USED IN INSPECTION FACILITIES

	Arizona*	California*	Illinois*†	Nevada*††	New Jersey	Ohio*	Oregon*	Rhode Island
HC-CO Infrared Analyzers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NOx Analyzers	No	No	No	No	No	No	No	No
Oscilloscopes	No	No	No	No	No	Yes	No	No
Timing Lights/Equivalents	No	No	No	No	No	Yes	No	Yes
Dwell Meters	No	No	No	No	No	Yes	No	Yes
Tachometer	Yes	Yes	No	No	No	Yes	Yes	Yes
Dynamometer	Yes	No	No	No	No	No	No	No

TABLE 3-31. I/M EQUIPMENT USED IN INSPECTION FACILITIES (CONT.)

	Arizona*	California*	Illinois†	Nevada*††	New Jersey	Ohio*	Oregon*	Rhode Island
CO_2 Analyzer for Validity Checks	Yes	Yes	No	No	No	No	Yes	No
Interval Requirements for HC-CO Analyzer Calibration	Twice weekly or more often as requir.	Daily or more often as required	Every 10 days	Every 30 days	Every 30 days	Every 30 days	Daily	Every 30 days**
HC-CO Analyzer Accreditation/Certification Requirements	No	Yes	No	Yes	Yes	Yes	No	Yes

* Selected counties/cities, see page 3-130.

** State inspection facility calibrates monthly, private garage (appointed system) required to calibrate weekly.

† Illinois inspection is voluntary. Should it become mandatory they would consider licensing and minimum equipment requirements.

†† Nevada's inspection, adjustment, and repair is performed by private garages (appointed system)

TABLE 3-32. EQUIPMENT REQUIREMENTS FOR INDUSTRY GARAGES PERFORMING ADJUSTMENT/REPAIR TO I/M FAILED VEHICLES

	Arizona†*	California††*	Illinois*	Nevada*	New Jersey	Ohio*	Oregon*	Rhode Island
HC-CO Analyzer Requirement	No	Yes	No	Yes	Yes	No	No	Yes
Oscilloscope Requirement	No	Yes	No	Yes	No	No	No	No
Timing Light/Equipment Requirement	No	Yes	No	Yes	No	No	No	No
Dwell Meter Requirement	No	Yes	No	Yes	No	No	No	No
Tachometer Requirement	No	Yes	No	Yes	No	No	No	No
HC-CO Analyzer Calibration Interval Requirement	No	No	No	No	No	No	No	Weekly

† Arizona has a registered analyzer program (voluntary) whereby the state will verfy analyzer calibrartion.
†† California requires the private garages engaged in adjustment/repair to meet the equipment requirement of the Class 'A' smog station program.
** New Jersey, re-inspection stations equipment requirements
* Selected counties/cities, see page 3-130.

- poor diagnosis
- improper repair and adjustment
- unnecessary repair in numerous instances
- inconvenience (ping-pong effect).

These experiences will be a major force working against the public and political acceptance of I/M.

Table 3-33 identifies those programs that have established cost limitations for vehicle repair and adjustment after emissions inspection failure.

Of the eight states studied, three states have cost limitations/ceilings on the amount a vehicle owner must spend to bring his vehicle into compliance. Arizona has a $75.00 parts and labor limitation. California has a basic limitation (tune-up/minor repair) of $50.00; for missing, altered, or inoperative emission control components, a maximum repair cost schedule has been adopted based upon year model groups, i.e., $85.00 maximum for 1955 to 1965 vehicles, $150.00 for the 1966 to 1974 vehicles and $250.00 maximum for 1975 and later year vehicles. Nevada has a $25.00 parts limitation and a $50.00 labor limit, not to exceed $75.00 combined. The Nevada limitation does not include costs for a missing or defective catalytic converter which would be an additional expense for vehicles 1975 and later if so equipped originally. Five states have a basic exemption procedure used in cases where cost of compliance would not be realistic in light of vehicle book value.

The existence of ceilings on repair may encourage the removal of emission control components/systems from the vehicle since the cost of replacing these systems/components is higher than the legislated ceiling. For example, catalytic converters from one major manufacturer retail in the range from $165.50 to $330.98.

TABLE 3-33. LEGISLATED COST LIMITATIONS/CEILING FOR REPAIRS

	Arizona*	California*	Illinois*	Nevada*	New Jersey*	Ohio*	Oregon*	Rhode Island
Have ceiling/cost limitations been established on maximum amount to be spent for repair?	Yes	Yes	No	Yes	No	No	No	No
Parts amount limit	Not Applicable (N/A)	Varies $85.00 through $250.00 depending on the vehicle's age.	N/A	$25.00	N/A	N/A	N/A	N/A
Labor amount limit	N/A		N/A	$50.00	N/A	N/A	N/A	N/A
Parts and labor amount limits	$75.00	Basic $50. for minor repairs on emis. equ.	N/A	$75.00	N/A	N/A	N/A	N/A
Is an exemption procedure/waiver in effect?	Yes	Yes	N/A	Yes	Yes	No	No	Yes
Is the exemption/waiver attached to the repair maximum?	Yes	No	N/A	Yes	N/A	N/A	N/A	N/A
Special circumstances	None indicated	None indicated	None indicated	None indicated	None indicated	X**	None indicated	X***

*Selected counties/cities see page 3-130. **Exemptions issued only under special circustances, initated by letter to the Department of Motor Vehicles and subsequent investigation by the DMV. ***Exemptions used only after vehicle specifications meet compliance with the manufacturer recommendations and vehicle is properly equipped, without modification from Original Equipment Manufacturer's standards.

3.6.3 Motor Vehicle Diagnostic Inspection Demonstration Programs

The Motor Vehicle Diagnostic Inspection Demonstration Program projects were established under the provision of the Motor Vehicle Information and Cost Savings Act of 1972 (Public Law 92-513). These projects were conducted by NHTSA in Alabama, Arizona, Tennessee, Washington, D.C. and Puerto Rico, and involved the Federal Trade Commission (FTC), the Department of Transportation (DOT), the Environmental Protection Agency (EPA), state and city governments, various universities, and private industry. Sixty-six thousand vehicle owners were voluntarily involved in the program and the vehicles inspected ranged throughout the 1968 to 1973 model year passenger car population.[21]

The work of this program has been summarized in the NHTSA report cited in reference 22. Under this program, over 125,000 thorough safety and emission inspections and re-inspections were conducted over a fifteen month period during 1975 and 1976. The purpose of each project, as mandated by the Motor Vehicle Information and Cost Savings Act was to provide the following:[22]

- Information and data on the costs and benefits of the projects.
- The capability of the motor vehicle repair industry to correct diagnosed deficiencies or malfunctions, and the cost of such repairs.
- Information and data on Vehicle In-Use standards and feasible reject levels.
- Information on efficiency of facility designs employed.
- Information and data on the standardization of diagnostic systems and test equipment.
- Development of diagnostic testing equipment designed to maximize the interchangeability and interfacing capabilities of test equipment and vehicles.

- Information on vehicle designs which facilitate or hinder inspection and repair.

Of those five states/jurisdictions involved, two states, Alabama and Arizona, did not have existing Periodic Motor Vehicle Inspection programs. Jurisdictions without PMVI failed about 90 percent of the vehicles on initial inspection. Collectively, 75 percent of the vehicles failed the initial inspection. Brakes, tires and wheels, emissions, and suspension sub-systems accounted for two-thirds of the $2.4 million spent on repairs. The average expenditure per vehicle repaired during the program, was $57.25 each.[21]

Some key findings and recommendations regarding these projects are itemized below. These would certainly apply to the PMVI and I/M programs in operation today, and are supportive of our analysis and recommendations for improvement:[22]

- Implementation of a program to develop, maintain, and document standards of tests and acceptance criteria that are common to all inspection situations
- Implementation of a program to assure calibration of the repair industry's test equipment so that a uniformly high quality control standard is evolved and maintained.
- Implementation of a program to develop technical liaison between the industry and the State inspection facilities, so that inspection processes, forms and acceptance criteria are understood. Liaison between industry and State inspection representatives would continously monitor problem areas and attempt to resolve differences.

Uniformity in vehicle inspection and use of test equipment is necessary. To this purpose we agree with the following recommendations contained in NHTSA's final report on the Motor Vehicle Diagnostic Inspection Demonstration Program:[22]

- Conduct a review of the Federal VIU Standards, the MVMA Handbook, SAE, ANSI, and other sources to optimize inspection criteria and general practices for the purpose of consolidation, and to provide quantitative criteria where they do not presently exist.
- Develop standards for calibration of test equipment used in both the inspection facilities and in the repair shops; these standards to include methods of maintaining quality assurance of the calibration procedures.
- Establish the level of experience and training required of the inspectors. In the opinion of several states the prerequisites for the position do not include experience as a highly skilled mechanic. Rather, the position requires receptivity to training in the use of specialized procedures and equipment. These states concluded that it is easier to train inexperienced personnel than retrain experienced mechanics (who had a proclivity to revert to perviously learned practices). Acceptance of this rationale would dicate a common training method as a means of achieving standardization
- The inspection result form given to motorists should be concise and non-technical. Standardize a form which, while providing this generalized information to the motorist, gives the repair shop an adequate definition of the inspection performed on the vehicle.

When assessing the effectiveness of the PMVI and I/M programs in operation today throughout the nation, these findings of the Motor Vehicle Diagnostic Demonstration Projects, a technically oriented program, support in part the findings of this study.

3.6.4 Evaluation of Current Programs

If the motor vehicles in operation today are to meet the in-use standards pertaining to fuel economy, safety, and emissions, they must be maintained to manufacturers' specifications. The intent of both DOT and EPA, through PMVI and I/M, is to achieve this objective. It is generally recognized that Government regulation and societal pressures have placed severe demands on the motor vehicle manufacturers:

- To build safer vehicles, increasing crashworthiness in an effort to save lives and reduce the financial costs to society
- To provide more efficient automobile designs which reduce fuel consumption
- To design and install emission control systems on all vehicles to reduce air pollution.

Generally, the Federal Government has taken a leading role in the aforementioned areas, so critical to our society and environment.

Unfortunately, many states have ignored their responsibilities. Both PMVI and I/M were designed to augment and enforce the Federal standards, but have yet to achieve an effective level of attainment.

As a result, the original intent of Congress to encourage the States in implementing inspection programs to conserve fuel, increase highway safety, lower vehicle costs of operation, and protect our environment, is being jeopardized.

3.7 ASSESSMENT OF THE PRESENT INSPECTION/MAINTENANCE/REPAIR SYSTEM

3.7.1 Identification of Service Criteria

The quality of service provided by the I/M/R industry has become a major issue in this country. Recent complaint related studies have identified certain categories of complaints, such as incompetence, overcharges, and fraudulent activity. The involved parties are currently engaged in lively debate regarding the true extent, cause, nature and distribution of consumer complaints.

Consumer groups, trade associations, auto manufacturers, parent companies, and independent research organization maintain certain complaint statistics. However, the reliability and scope of this data collection effort varies greatly. Some of the available data is not released for competitive or public relations reasons. On the retail level, hardly any customer complaint statistics are kept by the approximately 250,000 service performing outlets.

In order to correctly assess the quality of service provided by the I/M/R industry, two monitoring approaches are required:

- complaint identification and evaluation
- establishment of service criteria with on-going performance evaluation.

Indentification and evaluation of complaints should classify and analyze them by:

- complaint received during warranty period
- complaint received during post-warranty period
- complaint is product related
- complaint is service outlet related
- identification of service outlet category
- type of complaints

- number of complaints by category
- ratio of complaints to total maintenance and repair transactions.

Identification and mutual understanding of complaint nature, cause, and involved parties would tend to eliminate most causes for disagreement among industry, consumers, and government. At the same time valuable input for the development of corrective measures would be provided.

The establishment of service criteria in combination with on-going evaluation of the I/M/R trade group does represent a complex task. The benefits derived by all parties concerned, however, might more than offset the required implementation effort.

Table 3-34 identifies key service criteria, performance evaluation components, and possible information sources.

Some organizations with franchised dealers and service outlets are already applying these or similar performance yardsticks, usually referred to as operating standards.

As a means to motivate large segments of the I/M/R industry to further improve the quality of service offered, and in an effort to further motivate auto manufacturers to make service related product improvements, the following indicators lend themselves for nationwide application:

- evaluation, by independent organizations, of services offered on retail level, with ratings published and displayed
- publication (possibly on new vehicle Moroney label) of estimated maintenance and repair requirements (excluding accident repairs), expressed in hours per specified number of miles and years of operation

TABLE 3-34. KEY SERVICE CRITERIA

CRITERIA	PERFORMANCE EVALUATION PARAMETER	UNITS OF MEASUREMENT	INFORMATION SOURCE
<u>CONSUMER VIEWPOINT</u>			
Frequency and extent of service	visits to service outlet per specific # of miles	#/10,000 miles	Manufacturers' guidelines Consumer surveys Service outlet records
	hours charged for maintenance & repair work, excl. accident repairs, per specific # of miles	#/10,000 miles	
Quality of workmanship	correctness of problem diagnosis completeness of work performed vehicle performance and appearance	see manufacturer's specifications	Consumer surveys Service outlet records State agencies Franchisors' records Shopping services
Service availability and convenience	backlog of appointments	# of days	Consumer surveys Service outlet records Franchisors' records Associations' records Shopping services
	length of time vehicle is required by service outlet	# of days	
	average distance to service outlet	# of miles	
	visits required to correct problem	# of visits	
	availability of alternate transportation		
	waiting time before, during, and after repairs	hours waiting per visit	
	hours open for business	hours/week	

TABLE 3-34. KEY SERVICE CRITERIA (CONT.)

CRITERIA	PERFORMANCE EVALUATION PARAMETER	UNITS OF MEASUREMENT	INFORMATION SOURCE
CONSUMER VIEWPOINT (cont.)			
Extent and clarity of working agreement	degree of adherence to agreement regarding: type of work to be performed cost of services method of payment time of completion guarantee special agreements		Consumer surveys Service outlet records Shopping services
Treatment	attitude, behavior, and competence of service outlet employees		Consumer surveys Shopping services
Price	price comparisons		Market surveys
Guarantee	published conditions of the guarantee on services		Owner manuals Service outlet records Associations

TABLE 3-34. KEY SERVICE CRITERIA (CONT.)

CRITERIA	PERFORMANCE EVALUATION PARAMETER	UNITS OF MEASUREMENT	INFORMATION SOURCE
SERVICE OUTLET OWNER/OPERATOR VIEWPOINT			
Customer satisfaction	number and nature of complaints received	% of total number of customer transactions	Service outlet records Outside surveys
	customer retention	% of vehicles in operation	
Financial performance	labor sales & gross profit	$	Service outlet records Manufacturer's records Association's records
	parts sales & gross profit	$	
	operating expenses	$	
	Return on investment	$	
Public image	general business growth		Service outlet records Community media
	community acceptance		
	recognition, awards		

TABLE 3-34. KEY SERVICE CRITERIA (CONT.)

CRITERIA	PERFORMANCE EVALUATION PARAMETER	UNITS OF MEASUREMENT	INFORMATION SOURCE
MANUFACTURER, OIL COMPANY, FRANCHISOR VIEWPOINT			
Density and capacity of service network	# of service outlets # of workstalls # of technicians equipment inventory	in relation to vehicles in operation	Company records
Financial strength of service network	Profit/loss ratio of service outlets	#/year in each category	Company records
Service image	comparative market studies		Company records General surveys
GOVERNMENT VIEWPOINT			
Observation of relevant laws	fuel conservation standards emission standards safety standards consumer related regulations trade regulations	annual fuel consumption failure rates failure rates complaint statistics	Federal and State Agencies Attorney General Offices Consumer organizations

- publication of component failure rates by make and model. Base data is to be obtained during mandatory Periodic Motor Vehicle Inpsection on state level, similar to the approach described in Sub-Section 5.3.3.

Voluntary evaluation of the quality of products and services is common practice in other industries, for example, hotels and restautants. AAA is currently offering its repair facility rating services under a program called "Approved Auto Repair Services Program."

Fuel consumption, resale value, and accident repair ratings by make and model are published in the United States today. In West Germany, these and additional published ratings on the cost of vehicle operation (ADAC) and vehicle component failure/reject rates determined during mandatory inspections (TUV) keep the public informed.

Congress, recognizing the value of automobile related consumer information, passed the Motor Vehicle Information and Cost Savings Act in 1972 (PL 92-513), which not only required a consumer information study to examine susceptibility to damage, crashworthiness, and characteristics of the repair system, but authorized and directed the Secretary of Transportation (Title II, Section 201 c) "...to devise specific ways in which existing information and information to be developed relating to (1) the characteristics of passenger motor vehicles enumerated in sub-section (a), or (2) vehicle operating costs dependent upon those characteristics (including information pursuant to section 205 of this title), can be communicated to consumers so as to be of benefit in their passenger motor vehicle purchasing decisions."

Section 201 (d) of that Title, as amended (PL 94-364), further directs that: "The Secretary shall compile the information described in sub-section (c) and furnish it to the public in a simple and readily understandable form in order to facilitate comparison among the various makes and models of passenger motor vehicles with respect to the characteristics enumerated in sub-section (a). The Secretary may by rule require automobile dealers to distribute to prospective purchasers any information compiled pursuant to this sub-section."

3.7.2 Cost, Frequency and Quality of Service Performed - A Comparison of the United States with Germany

Actual cost and frequency of maintenance and repair data are not available in either the United States or Germany. Estimated data are available, however, for both scheduled and unscheduled maintenance/repair, and actual data is available (based on insurance claims) for accident damage repairs. Estimates of scheduled maintenance costs are based on manufacturers' published maintenance schedules. Actual data would probably differ from these estimates because some vehicle owners fail to follow the manufacturer's recommended maintenance schedule once their automobile is out of warranty.

Unscheduled maintenance/repair is difficult to estimate, because in addition to the technical character of each vehicle, unscheduled maintenance/repair depends heavily on the following factors:

- Age of the automobile
- Number of miles driven
- Operator's driving habits
- Conditions under which the automobile is operated.

These factors are different for each automobile in a nation's fleet. To estimate unscheduled maintenance/repair, assumptions about the four factors must be made. This is undoubtedly one of the reasons (in addition to competition) manufacturers do not publish estimates of unscheduled maintenance/repair for their vehicles.

3.7.2.1 Costs in the United States - Table 3-35 presents estimated life cycle and annual costs and frequency of scheduled and unscheduled maintenance/repair and accident damage for the United States automobile and light truck fleet. The data for scheduled and unscheduled maintenance/repair were taken from two studies done for the Department of Transportation by Arthur D. Little, Inc.[23,24] The cost data in 1975 dollars were adjusted to 1978 price levels with the Auto Repair and Maintenance component of the Consumer Price Index. Frequency of repairs, i.e., the average number of visits to repair facilities per year, were estimated from data in the ADL report[24] and from the authors' experience.

Accident damage cost was obtained from the Highway Loss Data Institute research data.[25] The cost and frequency are weighted averages for 1976 through 1978 models.

Confirmation of the total 5.1¢ per mile is the result of a 1976 study by the U.S. Department of Transportation's Federal Highway Administration.[26] This study shows the cost for a compact sedan to be 3.4¢/mile over a 10-year life and 100,000 miles of operation. When this figure is adjusted for inflation by the Auto Repair and Maintenance component of the CPI to 1978, it becomes 4.0¢/mile; and adding 0.8¢/mile for accident damage results in a cost of 4.8¢/mile. A similar calculation for a standard size sedan from the study results in a cost of 5.8¢/mile.

Further confirmation of the total 5.1¢ per mile cost comes from a study recently completed by Hertz Corporation.[27] Based on an intermediate car operated 10,000 miles per year, Hertz estimated 3.17¢ per mile for maintenance. To determine this maintenance cost, Hertz begins with proprietary maintenance data from its fleet operations and then adjusts the

TABLE 3-35. ESTIMATED AVERAGE AUTOMOBILE & LIGHT TRUCK MAINTENANCE AND REPAIR IN THE UNITED STATES - LIFE CYCLE AND ANNUAL COSTS & AVERAGE FREQUENCY - 1978 DOLLARS

Type of Maintenance/ Repair	Average Frequency of Maint./Repair per Vehicle per Year	AVERAGE COSTS				
		Vehicle Fleet (a) (Billion $)		per Vehicle (b) ($)		per Vehicle Mile (Cents)
		Annual	Life Cycle	Annual	Life Cycle	
Scheduled	1.5	16.1	161.0	140	1,400	1.4
Unscheduled	2.0	33.3	333.5	290	2,900	2.9
Accident Damage	0.1	9.4	94.3	82	820	0.8
Total	3.6	58.9	588.8	512	5,120	5.1

Assumptions:
- Based on 212, 1970-75 vehicles
- Entire U.S. fleet same as 212 vehicles
- Manufacturer's recommended maintenance actually performed
- Ten year vehicle life, 100,000 miles of operation

(a) Based on 115,000,000 vehicles
(b) Based on 10,000 miles of operation per year

data for special discounts and other advantages that fleet maintenance operations experience to arrive at what Hertz believes a private owner would experience. These figures are, therefore, applicable to the private fleet if it is believed that Hertz' adjustments are valid and accurate. This 3.17¢ does not include accident damage or minor maintenance repair. Minor maintenance and repair is included in the gas, oil and lube category, the total of which is 5.9¢ per mile. Calculations show that about 4.8¢ is gas, oil and lube so the remaining 0.8¢ must be minor maintenance and repair. If this 0.8¢ per mile is added, plus 0.8¢ per mile for accident damage (per Table 3-35), Hertz' comparable cost becomes 4.8¢ per mile.

3.7.2.2 Costs in West Germany - Data for West Germany similar to that in Table 3-35 is not available. What is available is estimated cost data by make and model. Scheduled and unscheduled maintenance/repair costs in cents per mile were averaged for some representative models. The average was 0.8¢ per mile (vs. 1.4¢/mile in U.S.) scheduled maintenance, and 1.8¢ per mile (vs. 2.9¢/mile in U.S.) for unscheduled maintenance. Accident damage and frequency of repairs were not available. These averages are considerably less than those for the United States vehicles shown in Table 3-35. The probable reason is that the West German data are based on three years of vehicle operation while the United States data covers ten years. Most major repairs do not occur in the first three years of vehicle life. The data of the two countries are not comparable, and until data for West Germany covering a ten-year life can be obtained, no meaningful comparison between the respective I/M/R costs can be made.

3.7.2.3 Quality of Service in the United States - There seems to be little question that the general quality of automotive maintenance and repair in the United States is relatively low and has been for years. A customer survey performed by NADA at the beginning of the decade concluded that one-third of them were not satisfied with repair work done the first time.[28] A more recent study indicated one out of three customers thought that work auto I/M/R had performed constituted poor workmanship or was not done right the first time.[29] Table 3-36 lists various studies on the quality of service over the last ten years with a short summary of their results. A caveat is in order because the definitions of unsatisfactory repair, incorrect repair, and poor or bad repair work are not uniform for all of the studies. The purpose of Table 3-36 however, is not to precisely define the quality of repairs and maintenance in the United States, but to provide a general, overall view.

3.7.2.4 Quality of Service in West Germany - Apparently the quality of I/M/R service is better in Germany, based at least on customers' evaluation of services received from the various trade channels. Table 3-37 shows customers' evaluation of the trade channels in the areas of quality of workmanship, convenience, treatment and price. The data was obtained by surveying 1,600 I/M/R consumers. Quality of workmanship shows a maximum of only two percent (dealer and service stations) of customers who were either dissatisfied or very dissatisfied. (However, a leading West German automobile manufacturer reports that, of those customers complaining to its dealers, poor quality work was the primary reason for complaint, followed by prices too high and waiting time too long). This is in sharp contrast to the United States where the majority of complaints are for incorrect, unnecessary, poor, or bad repairs. One area where German consumers do appear to

TABLE 3-36. STUDIES AND SURVEYS INDICATING THE QUALITY OF AUTOMOTIVE REPAIR AND MAINTENANCE SERVICE IN THE UNITED STATES

YEAR	SURVEY/STUDY	RESULTS/CONCLUSIONS
1969	"A Report on Defects in Automobiles and the Quality of Repair Work," Automobile Club of Missouri, May 1969.	Sixty-seven % of repair work categorized as either poor or bad.
1972	E. Mink, "Are You Getting What You Pay For?", The Midwest Motorist, Dec. 1974.	28.7% of repairs unsatisfactory
1974	E. Mink, "Are You Getting What You Pay For?", The Midwest Motorist, Dec. 1974.	37.7% received unsatisfactory repair work.
1975	L. Pipes and staff, Automobile Club of Missouri, "What's Being Done - and Proposed - To Help You Get More Dependable Car Repairs," The Midwest Motorist, Oct. 1976	54% of motorists received some repair work done incorrectly.
1975/6	W. A. Cook, "Repair Industry Response to Diagnostic Inspection Projects," SAE Technical Paper Series #780030 Table 1, p. 4, Feb. 27, 1978.	Reinspection failure rates at 5 Federal Government diagnostic test stations ranged from 19.7 - 31.8% with average of 27.7%.
1975	Auto Check Staff, University of Alabama, Huntsville, Alabama, "An Evaluation of Vehicle Repair Costs for Auto Check Participants," Feb. 1977.	24% of all repairs judged to be unnecessary and 32¢ of each repair dollar unnecessary.
1978	B. J. Schroer, W. F. Payton, J. F. Peters, University of Alabama, Huntsville, Ala., "The Quality of Automotive Repairs for Auto Check Participants," Jan. 6, 1978, UAH Research Report No. 209.	Unsatisfactory repairs: Engine System 35% Brake System 17% Suspension System 4%
1979	"Survey of Automotive Repair Practices," prepared for DOT, Office of Consumer Affairs by Johnson Center for Environmental and Energy Studies, University of Alabama, Huntsville, May 7, 1979.	52¢ of each repair dollar an unnecessary repair or fraud.

TABLE 3-37. CUSTOMER EVALUATION OF I/M/R SERVICES RECEIVED - A SURVEY BY A TRADE GROUP OF THE WEST GERMAN I/M/R INDUSTRY*

CRITERIA	RATINGS	FRANCHISED DEALERS (%)	INDEPENDENT GENERAL GARAGES (%)	SPECIALTY REPAIR SHOPS (%)	GAS SERVICE STATIONS (%)	MASS MERCHANDIZERS (%)	FLEET OPERATIONS (%)
QUALITY OF WORKMANSHIP	very satisfied	44.7	28.5	56.4	17.9	not available	not available
	satisfied	37.8	49.1	29.5	42.6		
	neutral	15.5	21.8	13.8	37.5		
	dissatisfied	1.2	0.6	0.3	1.4		
	very dissatisfied	0.8	--	--	0.6		
CONVENIENCE	very satisfied	27.1	26.7	17.6	not available	not available	not available
	satisfied	54.6	58.0	59.6			
	neutral	10.7	12.3	15.2			
	dissatisfied	6.5	2.6	6.4			
	very dissatisfied	1.1	0.4	0.8			
TREATMENT	very satisfied	33.2	30.8	30.0	39.2	not available	not available
	satisfied	38.6	45.7	43.7	40.6		
	neutral	22.9	22.2	23.2	18.7		
	dissatisfied	3.8	1.1	2.9	1.2		
	very dissatisfied	1.5	0.2	0.2	0.3		
PRICE	very satisfied	4.8	11.4	6.8	18.5	not available	not available
	satisfied	10.6	20.0	13.1	37.0		
	neutral	43.2	61.3	31.5	37.2		
	dissatisfied	25.2	6.2	28.2	5.5		
	very dissatisfied	16.2	1.1	20.4	1.8		

*Source: IIB

be dissatisfied is price. Forty—one percent were either dissatisfied or very dissatisfied with dealers' prices and forty-nine percent with repair specialists' prices. Based on interviews with manufacturers, the price of I/M/R service in the United States constitutes a small portion of consumer complaints.

3.7.2.5 Conclusions - Data of aggregate I/M/R costs for the United States and West Germany is not comparable and no conclusions could be reached regarding cost. The quality of I/M/R based on a single West German consumer survey and extensive United States studies seems to indicate that the quality of I/M/R service is better in Germany than in the United States.

3.7.3 <u>Trends in Adherence to Federal Standards</u>

The I/M/R industry obviously plays the major role in safeguarding the considerable efforts and resources vested in the design and manufacture of vehicles which meet Federal standards. In technical terms, vehicles in-use have to be operated in accordance with manufacturers' specifications during their entire life cycle. In order to achieve this ambitious goal, three prerequisites must be met:

- the I/M/R industry must have the required capacity and capabilities
- the vehicle user must follow pertinent maintenance and repair requirements
- the states must perform periodic inspections and verify complaince with Federal standards.

In this subsection, the I/M/R industry's performance during and after the vehicle warranty period is assessed.

3.7.3.1 Performance of I/M/R Industry during Warranty Period - The manufacturer's warranty has been defined in Section 3.3.

Maintenance and repair work during warranty periods is performed almost exclusively by franchised new vehicle dealers. Figure 3-6 is a representative example of so-called "service retention," based on records on manufacturers who have offered two year warranties. The graph illustrates that 90 percent of all vehicle owners patronize new vehicle dealers for car service during the first two and a half years of ownerhsip. Between two and a half and about eight years, service retention declines steadily to about 10 percent. The curve for manufacturers offering one year warranties would be similar, except that the sharp decline would begin a year earlier than in our example. It should be noted that these trends may vary considerably between the different dealer organizations. The near 100 percent retention rate during the warranty period, however, is achieved by most auto manufacturers' dealer networks. Consequently, an assessment of the performance of I/M/R industry during the warranty period amounts to an assessment of service offered by new vehicle dealers.

Today, most manufacturers and, in the case of imports, their marketing subsidiaries, consider customer satisfaction an essential corporate goal. Most dealer organizations make a strong effort to keep vehicle owners particularily satisfied during the warranty period. This statement could not have been made with equal strength only two years ago. Since then, manufacturers have been generally paying their dealers warranty rates equivalent to dealers' customer labor rates. This, combined with on-going simplification of warranty administration has generally eliminated dealers' reluctance to perform warranty work.

As outlined in Section 5.3.1 and 3.5 of this report, dealers receive considerable support from their parent companies.

Furthermore, today's franchise agreements stipulate

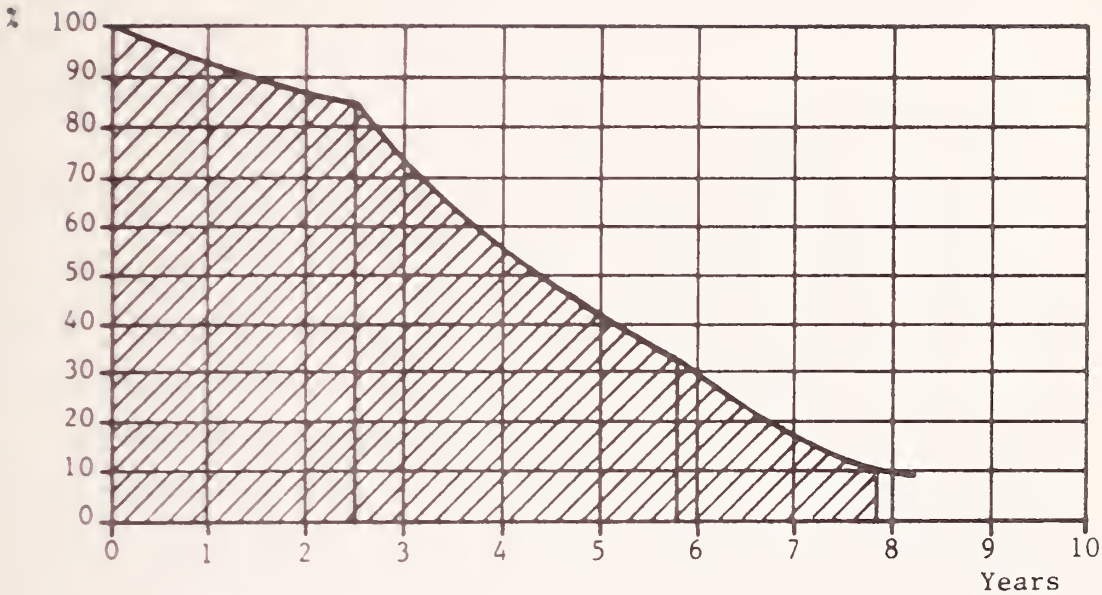

FIGURE 3-6. NEW VEHICLE DEALER SERVICE RETENSION

service and parts requirements dealers must meet. Adherence to these standards obviously varies among manufacturers' networks and individual dealers. Some manufacturers have not renewed franchise agreements for reasons of sub-standard service performance on the dealer's part.

Two aspects are often overlooked when evaluating automobile service: first, the need to visit a workshop is, from a customer's point of view, an inconvenience. Second, many so-called dealer shortcomings are in fact product shortcomings, for which a remedy may not exist at a given time. In the eyes of the mototist, this is usually judged as dealer incompetence. A third problem, unique to the warranty period, is caused by the newness of vehicle components and trim. Technicians may not yet be completely familiar with new mechanical components, despite preliminary training. Even when little mechanical change occurs, the parts supply for the new models may often be uneven, especially for trim and other cosmetic items. The personal experiences many motorists have when trying to correct vehicle deficiencies during the warranty period often overshadow the true efforts of most dealers.

From an overall point of view and with due consideration of the general difficulties in obtaining good service in today's society, the following conclusion can be reached:

> During the warranty period auto manufacturers and their dealers have sufficient network capacity and technical competence to comply with Federal vehicle in-use standards.

3.7.3.2 Performance of I/M/R Industry During Post-Warranty Period - As seen in Figure 3-6, service retention rates for new vehicle dealers drop after warranty expiration. The two reasons for this occurrence are:

- the vehicle owner has to pay for maintenance and repair work
- owners begin to trade their cars, and the used car buyer is less inclined to patronize the new car dealer's service department.

While new vehicle dealers continue to play a major role in the post-warranty labor and parts market, other members of the I/M/R trade group actively compete for this market. It is estimated that independent workshops, repair specialists, service stations, and mass merchandisers account for approximately 60 percent of the total labor and parts business today.

Any attempt to determine the degree of adherence to Federal standards during the post-warranty period would require a thorough analysis of repair practices currently used. A further study would have to focus on replacement parts and vehicle components used during the same period. Knowledgeable sources in the parts industry maintain that many parts and accessories used do not comply with OEM (Original Equipment Manufacturer) standards.

Another unknown factor is the mototists' adherence to recommended maintenance schedules or his/her willingness to have necessary repairs performed. This willingness usually declines as the automobile's age increases. In addition, a certain percentage of vehicles are operated without defects being identified.

Any assessment of the service industry's overall success or failure rate in maintaining vehicles in operation in accordance with current Federal standards would have to be based on quantification of alternatives A, B, and C.

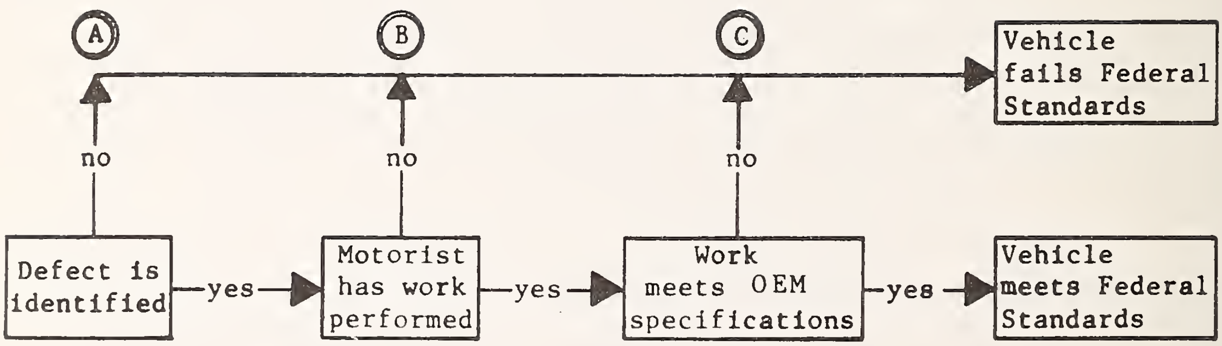

FIGURE 3-7. POSSIBILITIES OF MEETING FEDERAL STANDARDS

This information is presently not available for the United States I/M/R industry. As will be pointed out in Section 5.3, foreign inspection systems are providing this type on basic and essential data.

4. FUTURE TRENDS IN THE INSPECTION/MAINTENANCE/REPAIR INDUSTRY

4.1 TECHNOLOGICAL AND INDUSTRIAL IMPACTS

Technological changes in automobiles could have a substantial effect on the I/M/R Trade Group, both in the aggregate quantity of maintenance and repair to be performed by the Group and as to which members of the Trade Group get what share of the I/M/R market.

4.1.1 Forces Causing Technological Change

The forces bringing about technological changes may be divided into the three general areas of government laws and regulations, consumer demands, and competition. Figure 4-1 is a schematic showing these forces and their effect on the consumer and the automobile industry. The specific forces in these three areas are described below.

4.1.1.1 Government Laws and Regulations - Government laws and regulations exist in the areas of fuel economy, safety, emission, and noise. Most of the implementation has been at the Federal level, although the states have also passed some legislation. For example, California has its own emission and noise standards. Listed below are the Federal laws in these areas and the provisions that have an impact on technological changes.

Fuel Economy:

- Energy Policy and Conservation Act of 1975 - mandated new car fuel economy of 20 mpg by 1980 and 27.5 mpg by 1985, these standards to be the sales-weighted average of all models produced by a manufacturer (corporate average fuel economy - CAFE). The Act also amended the,

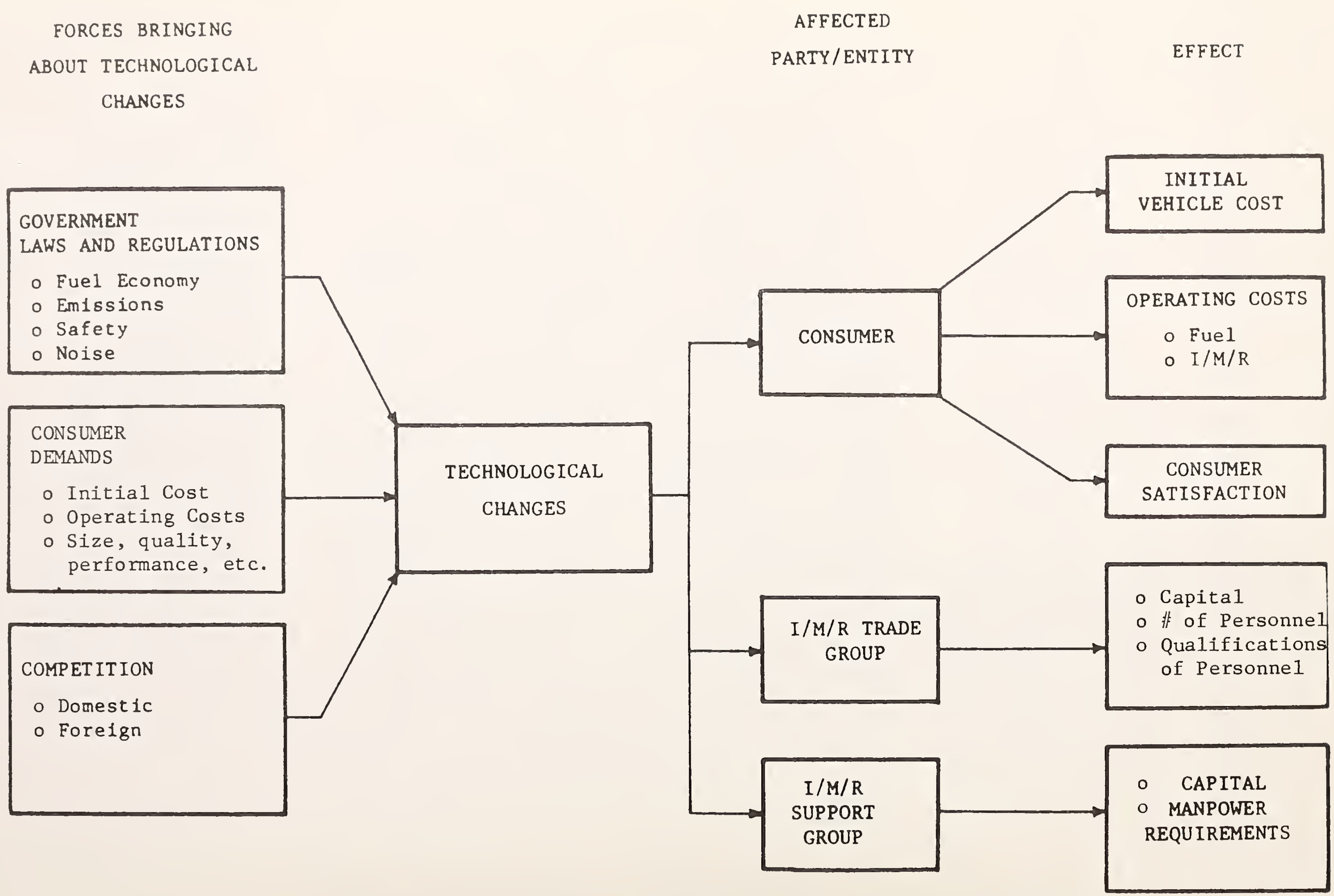

FIGURE 4-1. THE FORCES BRINGING ABOUT TECHNOLOGICAL CHANGES AND THEIR EFFECTS ON THE MOTOR VEHICLE INDUSTRY

- Motor Vehicle Information and Cost Savings Act (1972) - adding Title V which mandates the same fuel economy standards as above, and gave the Secretary of DOT power to set standards for 1981, 1982, 1983, and 1984.

Safety:

- National Traffic and Motor Vehicle Safety Act of 1966- through Federal Motor Vehicle Safety Standards (FMVSS) requires certain new vehicle components to comply with stated performance standards before the sale of the vehicle is allowed. Fifty-one standards are presently in force for passenger cars.[24,28]

Emissions:

- The Clean Air Act of 1963 - concerned with abatement of air pollution including automobiles. An amendment (Title II) passed in 1965 authorized HEW to set auto emission standards beginning with the 1968 model year.
- The Air Quality Act of 1967 - preempted the states from setting emission standards unless they had done so before 3/30/66. (California was the only state which had acted.)
- The National Environmental Policy Act of 1969 - established a broad policy of protection of the environment.
- The Clean Air Act of 1970 - amended the 1963 Clean Air Act setting automobile emission standards for CO, HC, NO_x at levels 90 percent below those for 1970 vehicles. The standards were to be met by 1975.
- The Clean Air Act of 1977 - amended the 1970 Clean Air Act and set new automobile emission standards. The Act also allowed a two-year waiver of the 1981 CO and NO_x standards under certain conditions and postponed a proposed 0.4 NO_x standard mandated by the 1970 Act

until further research was conducted.

Noise:

- The Noise Control Act of 1972 - gave the EPA authority to set standards and issue regulations for noise, including noise from automobiles. Automobile standards have not been set yet. Note: California has auto standards of 76 DbA for less than 35 mph and 82 DbA for over 35 mph. (Gasoline and diesel autos already meet this standard although the standard is not being actively enforced due to lack of funds.) Oregon has a current rule of 80 DbA maximum, but the Oregon Environmental Quality Commission rules for 1982 forbid the sale of cars and light trucks that exceed 75 DbA in a wide-open throttle test.

Other:

- Motor Vehicle Information and Cost Savings Act of 1972 - Title II - Requires NHTSA to determine crash susceptibility, crashworthiness, associated insurance costs, and ease of diagnosis and repair of mechanical and electrical systems of automobiles. The information is to be made available to the public for each make and model of automobile. The provisions of Title II have not yet been implementaed by NHTSA (Title III required the establishment of diagnostic inspection demonstration projects. See Section 3.6.3 of this report).

Potential:

- There are no existing Federal or state laws covering the following, but these are areas that could promote legislation and consequent technological change with a resulting impact on consumers and the I/M/R Trade Group.

- Electromagnetic radiation
- Body and frame corrosion (Canada is developing legislation)
- Particulate emissions from diesel engines
- Air pollution from air conditioner working fluids
- Standardization of electronic control systems, which would require auto manufacturers to design their systems so the same diagnostic equipment could be used on all makes and models.

Future safety requirements will undoubtedly have some impact on the auto I/M/R Trade Group. Passive restraint systems will be required in the 1982-1984 model years. The technology has already been developed, and implementation will probably not have a large effect on the I/M/R Trade Group. Noise standards also are not seen to have much impact on the industry. Although Federal noise standards have not been issued, if they were to be similar to California's, there would be no significant impact, since gasoline and diesel automobiles already meet those standards. Oregon's 1982 rule of 75 DbA maximum at wide-open throttle presents a problem, however. GM has stated that about 58 percent of its 1982 cars will fail to meet the standard.[30]

Fuel economy and emission standards are currently the strongest government forces leading to technological change and impacting the I/M/R Trade Group.

4.1.1.2 Consumer Demands - Even though a manufacturer designs and engineers an automobile to meet government requirements, it still must be acceptable to the market. Potential buyers are concerned with initial vehicle cost, life cycle cost (which includes fuel, oil, insurance, maintenance and repair), performance, vehicle size, quality, and appearance. These are forces which place constraints on technological changes and in turn affect the I/M/R Trade Group.

4.1.1.3 Competition - Products offered by other manufacturers, both domestic and foreign, exert pressure on a manufacturer to incorporate technological changes to equal or better others' products. These changes in turn affect the I/M/R Trade Group.

4.1.1.4 Relative Strength of Forces Causing Technological Change - Table 4.1 is an aggregate compilation of opinions from key automotive manufacturing personnel in Europe and the United States as to the relative strength of these forces in bringing about technological changes.

4.1.2 Technological Changes

4.1.2.1 Automobile Manufacturers' Assessment of probable Technological Changes during 1979-84 and 1984-89 Periods - In an attempt to forecast what technological changes (or further implementation of existing technology) would be incorporated in future automobiles over the next ten years, high level research/development, engineering and service personnel at various leading automobile manufacturers (both United States and European) were interveiwed. Table 4-2 lists technological changes or further implementation of existing technology that were mentioned by most of the interviewees. To be listed as a probable technological change, an incorporation rate of greater than ten percent in new vehicles had to be indicated by the interviewees. In addition, studies and reports were reviewed to further confirm that the changes listed were widely thought to have a high probability of implementation within the next ten years.[8,31]

TABLE 4-1. RELATIVE STRENGTHS OF FORCES IN BRINGING ABOUT TECHNOLOGICAL CHANGES

	Very Strong	Strong	Average	Weak
<u>Government Laws and Regulations</u>				
Fuel consumption (CAFE)	X			
EPA emission requirements	X			
State and Local emission requirements		X		
NHTSA safety requirements		X		
<u>Consumer Demands</u>				
Economy				
Vehicle purchase price			X	
Vehicle operating costs:				
Fuel and Oil	X			
Maintenance			X	
Repair			X	
Safety				X
Emissions				X
<u>Competition</u>	X	X		

Source: Interviews with automobile manufacturers

TABLE 4-2. SUMMARY OF PROBABLE TECHNOLOGICAL CHANGES

1976-84 PERIOD	1984-89 PERIOD
DIESEL ENGINES	DUAL DISPLACEMENT ENGINE
FUEL INJECTION	ELECTRIC CARS
LOCK-UP AUTOMATIC TRANSMISSION	TURBOCHARGERS
UNIBODY CONSTRUCTION	FOUR-SPEED AUTOMATIC TRANS. WITH OVERDRIVE
AERODYNAMIC IMPROVEMENT	LOW-PROFILE TIRES
FRONT-WHEEL DRIVE	INCR. USE OF ALUMINUM
INDEPENDENT REAR SUSPENSION	INCR. USE OF CARBON FIBER/GRAPHITE
RADIAL TIRES	SEALED BEARINGS
CORROSION CONTROL	ON-BOARD DIAGNOSTICS
DECREASED MAINTENANCE	GASAHOL FUEL
INCREASED PART INTERCHANGEABILITY	
COORDINATED PART LINES	
SEALED CARBURATORS	
THINNER GLASS	
INCREASED USE OF PLASTIC	
DOWNSIZING	
ADVANCED ELECTRONIC CONTROL SYSTEMS	

From all the technological changes that the manufacturers thought would be incorporated into future automobiles, they were asked to list what they thought would be the five most important changes. About half of the manufacturers did not respond. The other half seemed to agree that incorporation of diesel engines, downsizing and weight reduction, and electronic engine control systems would be among the most important changes.

4.1.2.2 Electronic Control Systems - Advanced electronic control systems (AECS) deserve special attention, partly because they are expected to be widely used in the very near future and partly because they involve a complex technology with which the I/M/R industry is not very familiar.

Among the domestic manufacturers, AECS installations will be widespread in the 1981 model year. AECS will be installed on virtually all General Motors products of 1981.[32] The first significant applications of AECS which have already been widely used in the industry in 1979 are precision fuel control and ignition timing systems to reduce emissions and improve gas mileage. These are expected to be followed by systems for controlling idle speed, canister purge, exhaust gas recirculation, choking for cold starts, air injection into the exhaust, anti-knock and shifting of the transmission.

Many other control and information systems that are not related to emissions and fuel conservation are envisioned, and, to some extent, already available as options; for example:

- automatic levelling
- anti-lock braking
- multiplexed wiring harnesses
- trip information (already offered on selected models)
- on-board diagnostics
- others.

It is realized by the industry that the design of the essential control systems should allow for "soft failure," that is, if the electronic system fails, the vehicle can be driven safely to a repair facility.

The trend to electronic control systems gave rise to new approaches to trobleshooting of AECS, namely self-diagnosis.[32] By this is meant that each essential control system is capable of monitoring its own performance and advising the driver by means of an appropriate signal (for example the traditional dashboard display) that service is needed. The maintenance technician would not be required to perform a diagnosis demanding electronic or computer skills, but simply follow the instructions provided by the monitoring system itself, for example, "repair subassembly X."

On board diagnostics for AECSs will tend to reduce the need for external diagnostic equipment, thus aiding small garages. It is generally thought, however, that this will not take place to any extent before 1985.[8,31] However, there will be a continued need for many years for off-board diagnostic equipment.

4.1.3 General Effects of Technological Changes on Automotive Service

Table 4-3 represents a compilation of manufacturers' opinions as to each technological change's effect on frequency of service, repair skills of technicians, special training requirements for technicians, special service equipment needs, and the effect on the interchangeability of parts during the periods 1979-1984 and 1985-1989. An "I" in the column indicates a probable increase in the particular service item, "D" a decrease and "N" indicates no change. For example, the increased incorporation of diesel engines into the fleet in the 1979-1984 period will cause an increase in service frequency, no change in the level or repair skills for technicains, and increase in special training requirements for technicians, an increase in

TABLE 4-3. GENERAL EFFECTS OF TECHNOLOGICAL CHANGES ON AUTOMOTIVE SERVICE FOR PERIODS 1979-84 AND 1984-89

Change	EFFECT ON SERVICE				
	Service Frequency	Repair Skills	Special Training Requirem.	Special Equipment Requirem.	Parts Interchangeability
1979-84 Period					
Diesel engines	I	N	I	I	D
Fuel injection	D	I	I	I	D
Solid locking automatic transmission	N	N	N	N	N
Unibody construction	N	N	N	N	N
Aerodynamic improvements	N	N	N	N	N
Front-wheel drive	(N)	N	N	I	N
Independent rear suspension	N	N	N	N	N
Radial tires	D	N	N	N	N
Corrosion control	D	I	I	N	N
Decreased maintenance	D	N	N	N	N
Increased part interchangeability	N	N	N	N	N
Coordinated part lives	N	N	N	N	N
Sealed carburators	D	D	D	(N)	N
Thinner glass	N	N	N	N	N
Increase plastics use	(N)	I	I	I	I
Downsizing	N	N	N	N	N
Advanced electronic control systems	D	N	I	I	N
1984-89 Period					
Dual displacem. engine	(I)	I	(I)	N	(N)
Electric cars	N	I	I	I	I
Turbochargers	N	I	I	N	N
Four-speed automatic trans. with overdrive	N	N	I	N	N
Low-profile tires	N	N	N	N	N
Incr. use of aluminum	N	I	I	I	I
Incr. use of carbon fiber/graphite	N	(I)	I	I	I
Sealed bearings	D	(D)	N	N	N
On-board diagnostics	(I)	I	I	I	(N)
Gasohol fuel	(I)	(I)	I	N	N

() Indicates disagreement among interviewees. Effect decided by authors special equipment required, and a decrease in the interchangeability of parts within the fleet. The symbol () is explained in the next paragraph.

Table 4-3 indicates that there was generally consensus among the manufacturers as to a technological change's effect on service. In some cases, however, there were differences of opinion. When this occurred, the majority opinion was used, or if there was a complete division of opinion, the authors selected the opinion they believed most correct. Parenthesis indicate those selections. For example, for sealed bearings there was one vote for an increase in service frequency, two votes for a decrease and one vote for no change. Accordingly, a decrease was indicated in Table 4-3. Again, for sealed bearings, there were two votes for a decrease in repair skills and two votes for no change. A decrease was selected and so indicated by parenthesis in Table 4-3.

4.1.4 Impact on Future Annual Inspection, Maintenance, and Repair Requirements

For the 1979-1984 period, seventeen technological changes are shown to occur (see Table 4-3). Out of these seventeen changes, one change is likely to increase service frequency, while six have a reducing effect, with ten changes anticipated to have no effect.

In the opinion of most manufacturers interviewed, the net result of all technical changes for the 1979-1984 period will be a reduction of maintenance and repair requirements for vehicles produced during these years.

This conclusion is based on current visible trends:

- Diesel engines, while requiring shorter oil change intervals, otherwise require significantly less maintenance than do gasoline engines,

- Radial tires increase tire life expectancy over regular type tires,
- Corrosion control will reduce the need to replace sheet metal parts,
- Increase in maintenance intervals will have a direct impact on the number of required workshop visits,
- Sealed carburetors will reduce potential labor intensive operations,
- Advanced electronic control systems will eventually have long trouble-free life expectancies (after early high failure rates).

At present, the annual number of hours required for maintenance (scheduled) and repairs (unscheduled) for a given car model, based on a specific number of miles, is not known.

Also unknown are market introduction dates for the various technological changes. As a result, any estimate as to the aggregate maintenance and repair requirements for the fleet in any given year, must at this time be considered speculation. The authors conclude that during the next ten year period, total annual maintenance and repair requirements for the fleet in use will show a constant decline. This conclusion is based on the following assumptions:

- In comparison to previous models, currently produced vehicles require less maintenance and repair during their expected life,
- The mix of vehicles in the fleet will shift annually in favor of these new-generation products,
- The average annual number of miles driven per vehicle in use will decrease as a result of fuel shortages and price increases.

4.1.5 Impact on the I/M/R Trade Group

The potential impact of technological changes on after-market trade channels is of concern to trade associations, members of the I/M/R Trade Group and selected government agencies.

Specific issues deal with:

- Future inspections, maintenance and repair requirements of vehicles in the fleet,
- Labor, capital, and facility requirements,
- Shifts of market shares within the Trade Group.

An attempt to quantify these trends is hampered by various factors:

- Automobile manufacturers are uncertain regarding nature of product design changes and degree of fleet integration,
- Lack of comprehensive reliable data on current maintenance and repair requirements for the fleet in use,
- Lack of reliable data on Trade Group network, type and volume of work performed by Trade Group members, and financial performance of Trade Group members.

Conclusions reached in the following two sections are based on a synthesis of this limited data base, on interviews, and on the authors' own observations.

4.1.5.1 Captial Investments and Operating Costs - Based on Table 4-3, "General Effects of Technological Changes on Automotive Service" (see Section 4.1.3), the following technological changes, anticipated for the 1979-84 period, are expected to result in increased requirements for special equipment and/or training:

Diesel engines, fuel injections, front wheel drive, corrosion control, increased use of plastics and advanced electronic control systems (AECS).

Discussions with four automobile manufacturers revealed the average dealer's minimum service equipment requirements for three out of six anticipated technological changes, as summerized in Table 4-4.

All manufacturers interviewed stated that current AECS's can be diagnosed with standard Volt/Ohm meters in combination with trouble shooting guidelines. Faulty components are then exchanged rather than repaired. Adherence to this service approach is intended to prevail in the future. It should be noted that tools and equipment in the higher price range are usually designed for speed and volume.

In a further attempt to determine the effect of product changes on special service tools, equipment and training requirements for dealers, two automobile manufacturers provided relevant information which is summerized in Table 4-5. It should be noted that both companies experienced major technical and product changes during the period observed. High annual requirements for tools, equipment and training shown in Table 4-5 signal major product changes.

The technological changes anticipated for the 1979-84 period, and the I/M/R Trade Group members who appear to be most directly affected by them are listed in Table 4-6. In this table, the selection of I/M/R Trade Group members is based on their current major activities.

Table 4-7 provides an overview of service tools and equipment costs in 1978 by establishment type. The figures in this table are based on 1975 costs, adjusted to 1978 dollars by applying a multiplier of 1.218. This multiplier represents a 3-year rise in the Consumer Price Index, averaged for metal working and electrical tools and equipment.

TABLE 4-4. IMPACT OF SELECTED TECHNOLOGICAL CHANGES ON SPECIAL SERVICE TOOLS, EQUIPMENT, AND TRAINING REQUIREMENTS (1978 DOLLARS)

Technological Change	Special Tools & Equipment		Special Training
	Type	Price Range	Work Days*
Diesel Engine	Tachometer Nozzle Tester Special Tools	\$190.00 - \$ 250.00 \$200.00 - \$ 400.00 \$100.00 - \$ 200.00	1 - 3
Fuel Injection	Amp/Ohm Meter Nozzle Tester (same as Diesel)	\$ 80.00 - \$ 300.00 \$200.00 - \$ 400.00	1 - 2
AECS	Electronic Tester	\$ 80.00 - \$1,300.00	1 - 2

* per required technician

TABLE 4-5. ADDITIONAL SPECIAL SERVICE TOOLS, EQUIPMENT, AND TRAINING REQUIREMENTS OF TWO AUTOMOBILE MANUFACTURERS, BY MODEL YEAR, FOR PERIOD 1974 - 1980

	Required Special Tools & Equipment for Model Year ($)		Required Technical Training for Model Year (Days)	
Manufacturer	I	II	I	II
1974*	not avail.	4,250.00	not avail.	8
1975	317.00	200.00		8
1976	417.00	665.00		2
1977	198.00	450.00	average 4	6
1978	486.00	400.00		2
1979	416.00	595.00		2
1980	1,305.00	170.00	7	4
Average per Model Year	523.00	961.00	4.5	4.3

*Model Year

TABLE 4-6. TRADE GROUP MEMBERS PRIMARILY AFFECTED BY TECHNOLOGICAL CHANGES, 1979 - 84 PERIOD

Primary Effect on:					
			Independent Repair Specialists		
Type of Technological change	New Vehicle Dealers	Indep. Gen. Garages	Tune-Up/ Diagnostic	Wheel Alignment	Body Repair
Diesel Engine	X	X	X		
Fuel Injection	X	X	X		
Front Wheel Drive	X	X		X	
Corrosion Control					X
Increased Use of Plastics					X
AECS	X	X	X		

TABLE 4-7. SERVICE TOOLS AND EQUIPMENT COST OVERVIEW BY ESTABLISHMENT TYPE (1978 DOLLARS)

				Specialty Shops (Av. 4 Bays)					
Tools and Equipment Categories	New Car Dealer (15 Bays) $	Service Station (3 Bays) $	Independ. Garage (5 Bays) $	Tune-Up A/C, Brakes (5 Bays) $	Radiator A/C (2 Bays) $	Diagnostic Tune-Up (2 Bays) $	Transmission (6 Bays) $	Muffler (5 Bays) $	Alignment (3 Bays) $
General	18,447	1,290	6,163	3,904	2,088	1,105	5,899	7,175	3,567
Cleaning	840	165	231	231	231	231	231	231	231
A/C Cooling	1,262	43	1,216	1,216	5,487	---	12	---	---
Alignment/Suspension	7,362	46	4,856	---	---	---	---	---	12,164
Brake	5,001	197	4,994	5,073	29	---	29	5,073	4,994
Clutch/Transmission	1,932	---	1,650	---	---	---	3,263	---	---
Tune-Up, Diagnosis	7,184	223	2,543	12,967	---	32,457	---	---	---
Electrical	1,901	353	334	244	292	314	244	244	244
Engine Repairs	3,141	---	2,582	---	---	---	---	---	---
Lubrication	1,615	247	923	---	---	---	290	---	---
Tire Service	2,293	810	1,989	---	---	---	---	10	1,300
Other	5,481	---	---	---	---	---	---	---	---
Subtotal (rounded)	56,500	3,400	27,500	23,650	8,130	34,110	9,970	12,735	22,500
Mechanics' Tools	13,300	2,120	3,200	2,720	1,084	646	2,996	2,144	1,950
Storage Equipment	15,500	incl.	incl.	incl.	730	incl.	incl.	3,045	incl.
Total (rounded)	85,300	5,520	30,700	26,370	9,950	34,760	12,970	17,930	24,450
Cost per Bay	5,690	1,840	6,134	5,274	4,975	17,380	2,162	3,585	8,150

Source: Reference 23, adjusted to 1978 dollars

A comparison of existing tools and equipment cost summary for affected I/M/R Trade Group members with the cost of additionally required tools and equipment for anticipated technological changes is provided in Table 4-8.

An anticipated average investment (between minimum and maximum levels) of $1,550.00 for test equipment, as shown in Table 4-8, would most likely be written off during the year of purchase. The resulting increase in monthly operating expenses for the affected I/M/R Trade Group member would be negligible. (In this connection it should be noted that permanently installed or other capital equipment is usually written off over a period of eight to ten years. Using current depreciation methods and available investment credits, considerable tax savings can be realized when purchases of such equipment are made.)

None of the technological changes currently taking place will have an impact on facility requirements for I/M/R Trade Group members. The present ratio of workstalls per technician is 1.7 (1,387,850 ÷ 809,705, see Table 3-6).

Since an industry accepted ratio is 1.25 stalls per technician, approximately 300,000 additional technicians could be employed in today's available facilities of I/M/R Trade Group members.

The authors come to these conclusions:

- Technological changes during the 1979-84 period will require only minimal tool and equipment purchases,
- The minimum required tools and equipment purchases represent a very small percent increase of available tool and equipment inventories,
- The impact of technological changes is further reduced by a gradual incorporation of the new products into the fleet,

TABLE 4-8. COST COMPARISON OF SPECIAL SERVICE TOOLS AND EQUIPMENT WITH EXISTING TOOLS AND EQUIPMENT INVENTORIES OF AFFECTED I/M/R TRADE GROUP MEMBERS

Line #		New Vehicle Dealers	Ind. General Garage	Tune-Up/ Diagn. Spec.
1	Subtotal for Tools & Equipment from Table 4.7	$56,500	$27,500	$34,110
2	Minimum Tools & Equipment Costs for Diesel Engine, Fuel Injection, AECS, (see Table 4.4)	$ 650	$ 650	$ 650
3	Line 2 as % of Line 1	1.1%	2.4%	1.9%
4	Maximum Tools & Equipment Costs for Diesel Engine, Fuel Injection, AECS, (see Table 4.4)	$ 2,450	$ 2,450	$ 2,450
5	Line 4 as % of Line 1	4.3%	8.9%	7.2%

- Increases in the monthly operating expenses of Trade Group members as a result of technological changes is negligible. As a rule, operating expenses are considered in the calculation of labor rates, thus not causing any undue burden on the Trade Group members.
- Any labor rate increase as a result of the technological changes would be negligible.

4.1.5.2 Effects of Technological Changes on the I/M/R Trade Group Members' Market Shares - Table 4-9 presents a compilation of the manufacturers' opinions as to which members of the I/M/R Trade Group will gain or lose in market share as a result of technological change. The symbols in this table have the same meanings as those in Table 4-3.

Generally, it appears that those technologies which require an addition of capital and special training will give dealers, repair specialists, and mass merchandizers an advantage at the expense of small general garages and gas service stations.

It has been suggested that new technology could be more readily absorbed into the national I/M/R system if the hardware based on it were standardized among manufacturers. For instance, the same diagnostic equipment could be used to troubleshoot most, or all, vehicle makes. However, such standardization would severely inhibit technological innovation in such fields as automotive electronics. It would also be strongly objected to by auto manufactuers on the grounds that they would lose competitive advantage, and that it would be in violation of existing anti-trust laws. In the end, such standardization in the case of electronic control systems may turn out to be unnecessary, should their key functions be designed with a self-diagnosing capability, as discussed in Section 4.1.2.1.

Nonetheless, as concluded in the previous section, technological changes for 1978-84 period will not have a

TABLE 4-9. GENERAL EFFECTS OF TECHNOLOGICAL CHANGES ON I/M/R TRADE GROUP MEMBERS' MARKET SHARE FOR PERIODS 1979-84 AND 1984-89

Change	EFFECT ON I/M/R TRADE GROUP MARKET SHARE					
	Dealers	Independ. General Garages	Specialty Repair Shops	Gas Service Stations	Mass Merchan-dizer	Auto/Home Supply Stores
1979-84 Period						
Diesel engines	I	D	I	D	I	I
Fuel injection	I	D	I	D	N	N
Solid locking automatic transmission	I	N	I	D	N	N
Unibody construction	N	N	N	N	N	N
Aerodynamic improvement	N	N	N	N	N	N
Front-wheel drive	I	D	I	D	N	N
Independent rear suspension	N	N	N	N	N	N
Radial tires	N	N	N	N	N	N
Corrosion control	N	N	N	N	N	N
Decreased maintenance	(N)	(N)	(N)	(N)	N	(N)
Increased part interchangeability						
Coordinated part lives						
Sealed carburators						
Thinner glass						
Increase plastics use	I	D	I	D	(N)	(N)
Downsizing	N	N	N	N	N	N
Advanced electronic control systems	I	D	I	D	N	N
1984-89 Period						
Dual displacem. engine	I	D	N	N	N	N
Electric cars	I	N	I	D	D	D
Turbochargers	I	(D)	I	(D)	N	N
Four-speed automatic trans. w. overdrive	N	N	N	N	N	N
Low-profile tires	N	N	N	N	N	N
Incr. use of aluminum	I	D	I	D	N	N
Incr. use of carbon fiber/graphite	I	D	I	D	N	N
Sealed bearings	N	(N)	(N)	N	N	N
On-board diagnostics	I	D	I	D	N	N
Gasohol fuel	N	N	N	N	N	N

() Indicates disagreement among interviewees. Effect decided by authors.

noticeable impact on Trade Group members or on overall financial performance, and, accordingly, will have little effect on market share.

Recent trends in market share, as shown in Figure 4-2, and the continuation of those trends result from a variety of market forces which are far stronger than any anticipated technological impacts.

Consumers expect primarily quality of workmanship, convenience of service, good personal treatment, and a reasonable price/value relationship. To a large extent, market share is determined by the degree to which individual members of the I/M/R Trade Group meet these consumer expectations. Certain Trade Group members, such as independent repair specialists and mass merchandizers, have developed networks wich benefit from sophisticated merchandizing techniques and the application of standardized business systems.

Market shifts will, in any event, be gradual, allowing individual business operators to provide for necessary adjustments. An owner of an independent workshop or gas service station, for example, might acquire a repair speciality franchise.

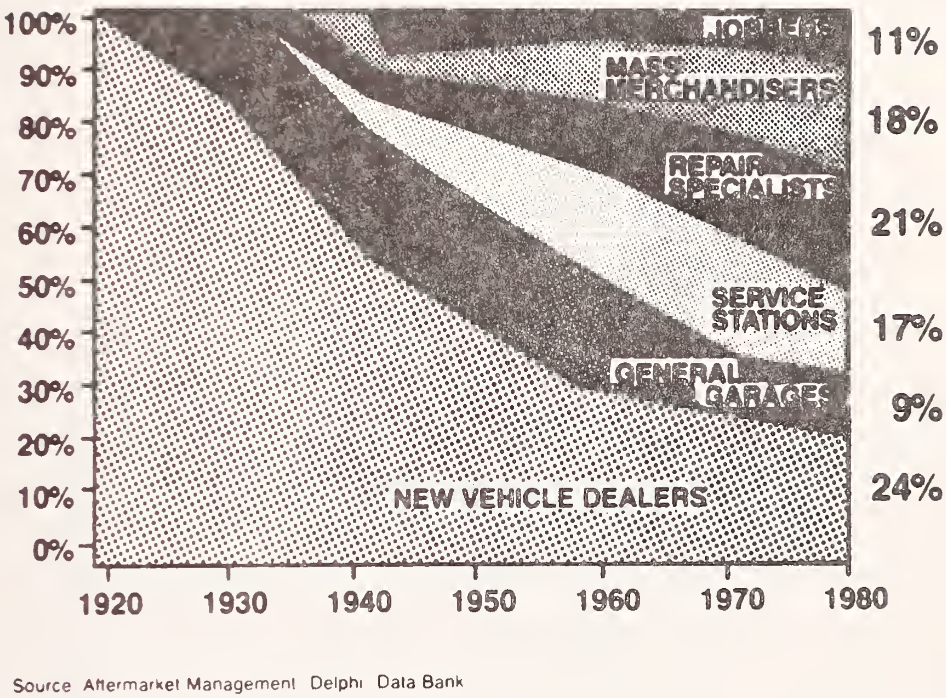

FIGURE 4-2. MARKET SHARE DEVELOPMENT OF I/M/R TRADE GROUP MEMBERS, 1920 - 1980

4.2 CONSUMER PROTECTION

When a consumer is dissatisfied with a post-warranty repair, his complaint may be resolved by the I/M/R industry itself, through self-help, or by state or local government through administrative action backed by law. The handling and resolution of complaints and the level of protection afforded the consumer by these general remedies are discussed below.

4.2.1 Industry's Methods

4.2.1.1 Dealers/Manufacturers

Traditional Methods:

The dealers of each automobile manufacturer have some differences in the methods they use in handling customer complaints, but the general procedure or sequence is basically the same. First the customer complains to the dealer service manager. If this fails, the next step is to contact the dealer owner (VW suggests this). If the dealer fails to resolve the consumer's complaint, he can appeal to the manufacturer via the regional or zone office. The final step is for the consumer to contact the manufactuer's division or corporate headquarters. Table 4-10 is an aggregation of 1978 complaint information for two domestic and two European manufacturers.* As can be seen, complaint information at the dealer or initial complaint level could not be obtained and is not likely to be available at all, as little recordkeeping activity occurs at this level. In addition, several manufacturers did not have information available for some categories. The information does, however, give an idea of the number of complaints that progress beyond the dealer level and of the response times of the manufacturers in resolving complaints.

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*The companies requested not to be identified.

TABLE 4-10. CONSUMER COMPLAINT HANDLING BY TWO DOMESTIC AND TWO EUROPEAN AUTOMOBILE COMPANIES (1978)

Organizational Level	No. Employees Handling Complaint		No. Complaints Reaching Level	Average Response Time per Complaint	Average Complaint Resolution Time
	Full Time	Part Time			
Service Outlet (dealer)	NA	NA	NA	NA	NA
Zone or Regional Office	589	857	357,844	1-3 work days	20 work days
Division or Corporate	187	14	210,513	1-3 work days	20 work days

The usual method of informing consumers of "how to complain" is through an explanation in the owner's manual and warranty statement which come with new cars. Other methods, such as dealership employees informing the customer or signs in the dealer service and sales offices, are mostly discretionary with the individual dealer. In addition to the owner's manual, at least one manufacturer (VW) informs consumers via its "Small World" magazine, distributed to owners quarterly. In a supplemental program, General Motors has distributed a booklet describing GM's complaint resolution mechanism to over 1,100 Federal, state, and local government agencies.

New Programs:

AUTOCAP - Automotive Consumer Action Program is a voluntary complaint resolution program sponsored by NADA and the National AUTOCAP Council. These two groups approve and assist in organizing AUTOCAP programs for state and local new vehicle dealers' associations. Staff functions are handled by a local manager who reports to the sponsoring dealer association.

Consumer complaints unresolved at the dealer level are reviewed and impartially mediated by a panel of dealers and consumer representatives. The panels consist of at least fifty percent consumer representatives and meet as often as necessary to handle their case loads, but no less than four times per year. A consumer's written complaint is acknowledged by the AUTOCAP, and is then forwarded to the involved dealer, who is given a reasonable time to respond to the complaint. Complaints remaining unresolved after this step are mediated by the AUTOCAP panel. Although dealers are bound by the panel's decision, consumers are free to pursue other remedies.

Manufacturer/Dealer Arbitration - The big three domestic manufacturers are testing consumer protection programs that supplement regular complaint handling procedures. The chief and common characteristic of these programs is some form of arbitration.

Ford's program started in 1977 and is being tested in the states of North Carolina, New Jersey, Washington, Oregon, Maryland, Virginia, California, and in the District of Columbia. It involves Ford and participating dealers and covers all service-related problems. If a consumer's complaint is not satisfied through the traditional method, it goes to the Ford Consumer Appeals Board consisting of five members; a Ford dealer, a Lincoln-Mercury dealer, and three consumer representatives. The Board's decision is binding on Ford and the dealer, but not on the customer. Customers are informed of the program by the dealers and through advertising.

GM's program is more limited in that it does not involve dealers, and covers only warranty complaints (12 months/12,000 miles) and GM's product liability up to 3 years or 36,000 miles. The program was begun in June, 1978, and operated in Minneapolis-St. Paul, Buffalo, and the San Francisco Bay areas. The procedure is set out in the owner's manual and requires exhaustion of the traditional complaint procedure before requesting arbitration. Arbitration panels in both test areas are provided by the Better Business Bureau (BBB). Third party mediation is attempted prior to arbitration - by the BBB in Minneapolis-St. Paul and by an AUTOCAP panel in buffalo.

As an indication of the effectiveness of the programs, the 175 cases processed in 1978 by one manufacturer produced the following results:[33]

. 45 still pending

. 110 settled through mediation either by dealers, zone representatives or a third-party mediator.

. 20 by arbitration of which:

- 8 won by manufacturer
- 6 partially won by customer
- 1 completely won by customer
- 2 where manufacturer was ordered to repurchase car
- 3 pending final decision.

Chrysler's test program began in March, 1979, in Nassau County, New York. The program includes Chrysler and participating dealers with arbitration provided by a board consisting of a certified mechanic, a consumer advocate, a representative from the participating dealers, and a representative of Chrysler's zone office. The board's decision is binding on the dealer but not on the customer. The program meets FTC regulations which require that there be:

. Independent panel members

. 40 days maximum for resolving the dispute

. Record keeping that allows FTC to measure success of the program.

The customer procedure is to first appeal to the Chrysler zone office where the dispute is mediated. If this fails, the customer applies to the board for a hearing and if the board decides the complaint qualifies, the customer is given a hearing date. The board may inspect the car and obtain the dealer's records. There is no oral argument before the board. If the dealer is ordered to take action, the board will follow up to insure the action is completed. Based on the test results, Chrysler believes the program is successful for Chrysler, its dealers, and their customers.[34]

So far none of the importers have established programs. VW and Porsche/Audi, however, have stated that they will participate in an arbitration test program commencing in Des Moines in June, 1979.

4.2.1.2 Independent Garages and Specialty Repair Shops - Automotive Service Councils, Inc. (ASC), an organization serving independent automotive repair firms, has recently begun a consumer protection program that is similar to the AUTOCAP program. It is planned that the program will be available to all members of the service industry except dealers. The arbitration boards will be composed of one consumer, one legal, and three industry representatives. ASC hopes that the boards will reach decisions more quickly than have the AUTOCAP panels. The only operational program at present is in Tuscon, Arizona.

4.2.1.3 Service Stations/Oil Companies - The estimated 74,250 service stations offering I/M/R services are either owned/ franchised by oil companies or are independently owned. It is difficult, therefore, to discuss service station complaint handling as an entity. Many of the oil companies, however, have consumer protection programs either in operation or planned, and at least one oil company association is developing such a program.

Perhaps the best known oil company program is Shell's Auto Care which has been in effect for six years on a test basis and is presently being expanded (currently includes 1860 stations). Auto Care is voluntary and service station dealers must request the program and qualify by meeting established equipment and operating standards (the dealer signs a separate franchise agreement). Under the program, the dealer agrees to:

- a 90 day, 4000 mile warranty on parts and service
- provide a written estimate and return parts to the customer (required by law in some states)
- submit to binding arbitration if requested by the customer
- provide at least one certified mechanic; initially certified by Shell and by NIASE within 1 year.

Auto Care dealers have a lower complaint ratio than non-Auto Care dealers, showing that Auto Care has a positive effect on customers and dealers. Shell also monitors complaints from all stations, including Auto Care stations, and where a station receives more than one complaint per quarter in the same category, the Shell district office investigates. Whatever action necessary is taken, including the use of rigged cars if fraud is suspected (very small number of cases). Shell is working to meet a target level of consumer satisfaction and will continue to improve the system until that level is attained.

Chevron U.S.A.'s Hallmark Award Station has features similar to Shell's Auto Care. With input from the White House Consumer Affairs Office, Union Oil Company is developing a program that will have features similar to Shell's, and with a strong mechanic certification emphasis. At least one mechanic at each station must have passed Union's test, which consists of a written exam (weighted 40 percent) and a performance or "hands-on" exam (weighted 60 percent). Sohio is somewhat unique in that 70 percent of its stations are company owned and operated by company employees. Its new program will essentially guarantee satisfaction to the consumer similar to the approach taken by the mass merchandizers.

The American Petroleum Institute has organized an auto repair task force comprised of representatives from member oil companies to increase consumer protection through training of service station mechanics, development of a voluntary code of I/M/R conduct for service stations, and working with state and local consumer affairs agencies. The program will not attempt to eliminate or compete with the oil companies' individual programs.

4.2.1.4 Mass Merchandizers - Mass merchandizers such as Sears, Penneys, and K-Mart handle auto I/M/R complaints in the same manner that they handle other service and merchandise complaints.

The complaint is processed by the store's consumer complaint department, which then attempts to satisfy the customer. K-Mart's policy is to essentially guarantee customer satisfaction. If the complaint is legitimate, they will redo the work, have the work completed by another shop, or refund the customer's money. If the customer is considered unreasonable and will not agree to K-Mart's remedy, he is left to his own recourse (court action, etc.).

4.2.2 Third Party Programs

Consumers have made efforts to protect themselves through third parties such as auto clubs. The American Automobile Association (AAA) is a federation of auto clubs throughout the U. S. and Canada with more than 18 million members. The AAA presently has two major programs designed to protect its members (and non-members) in the I/M/R area. The separate programs consist of rating auto repair shops and offering diagnostic services.

The rating program, entitled "Approved Auto Repair Services," began as a pilot program in Washington, DC, and Orlando, Florida. It has expanded to include other areas of Florida, a part of southern California, southeastern Minnesota, and the cities of Houston, San Antonio, and Milwaukee. As of January, 1979, 270 facilities had been approved. A repair shop qualifies by providing certain services (tune-up, minor engine repair, brakes, electrical systems, and either tires, steering and suspension or heating and air conditioning), by meeting certain equipment requirements, by providing clean, safe customer waiting facilities, by maintaining an approved facility appearance, by meeting staff and training qualifications, (including a NIASE certified mechanic qualified in each area of service), by having an acceptable community reputation, and by maintaining liability and property damage insurance. Once qualified, the shop must sign a contract with AAA agreeing to:

. offer a written estimate to AAA members

. make available replaced parts

. provide a guarantee of 90 days or 4000 miles

. cooperate with AAA in resolving member complaints and abide by AAA's decision.

An additional, interesting feature of the program comes into play when the shop calls the customer to inform that more work needs to be done than had been estimated. At that time, the customer may call AAA, who will send a representative to the shop to ensure that the extra work actually needs to be performed.

Based on member rating cards returned to AAA, satisfaction with the program is very high. Between January, 1976 and January, 1979, ninety-four percent of members were satisfied with the quality of service, and ninety-five percent would return to the facilities for future service.

The second program operated by AAA consists of diagnostic car clinics in St. Louis, Kansas City, San Francisco, San Jose, Philadelphia (operational at the end of 1979), and Toronto, Canada. In forty-five minutes to one hour around 400 checks are performed on each car going through the clinics. The cost is about thirty dollars per car. The motorist is told what is wrong with the car and what must be done to put the vehicle in satisfactory condition. AAA does no repair work itself, but will re-examine the vehicle (for one dollar) to ensure that repairs have been properly performed.

4.2.3 Consumer Self-Help

Consumers in the Washington, D.C., area can use a facility rating guide called "Washington Consumer's Checkbook" (1976), and its update (1978), published by the Washington Center for the Study of Services. The ratings are based primarily on customer surveys, although the number of complaints received by government consumer affairs offices are also shown along with the number of NIASE certified mechanics employes. The firm's hourly rate and whether AAA approved is also indicated. The Checkbook program does not include a check to see that claimed work is in fact needed or has been performed, nor does it have an arbitration arrangement as does the AAA program.

4.2.3.1 Auto Repair Cooperatives - Consumers have also taken action to protect themselves through formation of auto-repair cooperatives. To join, the consumer pays a one time membership fee or purchases a share of stock which entitles him to auto repair at the co-op. Members, through their votes, control the co-op, which often employes a manager to run the business. An example of a cooperative is Co-Op Auto located in Ann Arbor, Michigan. Following is some summary data on Co-Op Auto:

Number of members	- 1700
Cost/share (to join)	- $100
Labor rate	- Low-side of market (presently $20-22/hour)
Mechanics paid	- Flat-rate (Chilton or Mitchell)
Staff	- 25 including service manager and administration
Service manager paid	- Salary
Parts	- Similar to dealer operation - parts department with mark up
Mechanic certified	- all NIASE certified
Do-it-yourself	- use of workstall and tools provided for a fee.

Classes on car ownership, maintenance and repair are available, as is personal tutoring in performing repairs and maintenance.

According to co-op manager, Dave Fredericks, the co-op members have been very satisfied with the operation.

4.2.3.2 Consumer Associations - Another area of consumer self-help involves consumers joining together into an association to assist each other with auto-repair problems, and perhaps to testify before legislative bodies on behalf of the membership. One example is the Automobile Owners Action Council in Washington, D. C. The Council's 10,000 members in the metropolitan area pay an annual membership fee of $25 each. This approach to consumer protection does not appear to be widespread.

4.2.3.3 Consumer Knowledge - Consumers wishing to increase their knowledge of auto repair/maintenance (for self-protection or to perform their own work) will find a plethora of information available from private and government sources.[35] Consumer knowledge is perhaps the answer for a small percentage of consumers, but hardly for the majority, since most information indicates that few consumers even read their owner's manuals.

4.2.4 Government Laws and Programs

Although the Federal Government is actively studying methods to protect consumers, with the exception of the Magnuson-Moss Warranty - Federal Trade Commission Improvement Act (controls manufacturers' warranties), and the Motor Vehicle Information and Cost Savings Act (requires ease of diagnosis, repair and damage susceptibility information to be published by model - not implemented yet), there are no existing federal laws that specifically protect the auto I/M/R consumer. Government protection of the auto I/M/R consumer rests with the state and local governments.

4.2.4.1 Existing Consumer Protection Laws - State and local government laws are of three basic types:

Disclosure Laws: Require that certain information be provided the consumer, such as written estimates with customer authorization, written invoices detailing parts and labor, and the right to inspect defective parts that have been replaced.

Facility Licensing Laws: Require that auto repair facilities be licensed by the government and refrain from deceptive practices or face loss of their license and the right to do business.

Mechanic Licensing Laws: Require mechanics to meet certain competency standards before being allowed to carry on the business of repairing automobiles.

Table 4-11 shows the present status of laws in the fifty states, the District of Columbia, and the two cities which have enacted statutes. All government entities have a regulatory body responsible for issuing regulations pursuant to consumer protection laws passed by their legislative body and for enforcing these statutes. Some states have set up a separate bureau of automotive affairs, while others use the department of motor vehicles, office of consumer services, or office of their attorney general to carry out this function. As can be seen from the table, half of the states have no law of any kind, though bills are pending in several states. Only two states (Michigan, Hawaii) and the District of Columbia have mechanic licensing laws.

The auto repair and maintenance laws of the states of California and Michigan are comprehensive and well drafted. They are often used as models by other states in drafting their statutes.

4.2.4.2 Consumer Protection Laws in California - California's statute covers all auto repair firms except those which work on their own fleet vehicles, or that work on the vehicles of a

TABLE 4-11. STATUS OF AUTO REPAIR & MAINTENANCE LAWS IN THE STATES AND MUNICIPALITIES AS OF MAY 1979 (a)

STATE OR CITY	NO LAW	M.V. REPAIR BUREAU	DISCLOSURE LAW	LICENSE MECHANICS	LICENSE FACILITIES
Alabama	X				
Alaska			R^2		
Arizona	X				
Arkansas	X				
California		E^1	E^1, E^7		E^1
Colorado			R^3		
Connecticut		E^1	E^4	P	E^1
Dallas			E^3		E^3
Delaware	X		P		
Florida			E^3		P
Georgia	X				
Hawaii		E^4	E^5	E^4	E^4
Idaho			R^4		
Illinois	X		P	P	P
Indiana	X				
Iowa	X		P		
Kansas	X				
Kentucky	X				
Louisiana	X				
Maine	X		P		
Maryland (b)			E^3		
Massachusetts		P	E^1		P
Michigan		E^3	E^3	E^3	E^3
Minnesota			E^7		
Mississippi	X				
Missouri	X		P		
Montana			R^2		
Nebraska	X				
Nevada			E^4		
New Hampshire			E^4		
New Jersey			E^2		P
New Mexico	X				
New York		E^4	E^4		E^3
N. Y. City			E^1		
North Carolina	X				
North Dakota	X				
Ohio			E^1, E^7		
Oklahoma	X		P	P	P
Oregon			E^6		P
Pennsylvania			R^4		
Rhode Island			P	P	E^3
South Carolina	X				
South Dakota	X				
Tennessee	X		P		P
Texas		E^1	R^3		P
Utah			E^5		
Vermont	X				
Virginia			E^7		
Washington			E^6		
Washington, DC		E^3	E^3	E^3	E^3
West Virginia	X				
Wisconsin			E^5		
Wyoming	X				

KEY: E - Enacted by legislation R - Regulation issued by department
P - Pending bill in 1979

E / P	R
1 - prior to or in '72	1 - in '75
2 - in '73	2 - in '76
3 - in '74	3 - in '77
4 - in '75	4 - in '78 or '79
5 - in '76	
6 - in '77	
7 - in '78 or '79	

(a) Sources: 36, 37

(b) Repair facilities must be licensed in Montgomery and Prince George Counties.

single commercial, industrial, or government establishment, or which perform only minor maintenance (e.g. changing tires, lubrication, batteries, wiper blades, etc.). Excluded firms, however, can be brought within the statute if the Consumer Affairs Director finds that mechanical expertise is required, that vehicle safety is involved, or that the services performed give rise to a high incidence of fraud. A repair firm's employees are excluded from liability, placing the entire responsibility on the firm's owner/employer. The Act created a Bureau of Automotive Repair (BAR) responsible for enforcement of the Act and the issuing of rules and regulations. A Board was also created with five public and four auto repair industry members to monitor the practices of the auto repair industry and make recommendations to the BAR.

An establishment becomes registered or licensed by completing an information form and paying a fee ($50 per year). Licenses may be temporarily or permanently revoked for acts, or omissions to act, in violation of the law. Criminal penalties may also be imposed, and a consumer's right to civil action is not preempted by the Act.

The Act requires repair establishments to take certain affirmative steps. These are:

- Customer must be given a written estimate which cannot be exceeded unless the customer consents orally or in writing. Subcontracted work must be designated (the shop is held responsible for the subcontracted work).
- The customer must be provided an invoice itemizing both labor and parts. Used parts must be designated as such.
- Replaced parts must be returned to the customer. If too large, or if warranty parts, the customer has a right to visually check the parts.

The repair shop must post a sign approved by the Bureau stating the customer's rights and giving the Bureau's telephone number.

Approximately 33,000 of an estimated 80,000 facilities are licensed in California (the remainder are exempt). BAR's annual revenue for fiscal year 1977-78 was about $3.8 million, most of which was received from licensing fees. Annual expenditures were also about $3.8 million. In fiscal 1977-78, over 120,000 consumers contacted the Bureau, 26,660 written and telephone complaints were received, and 25,556 complaints were resolved. About $659,000 in price adjustments and additional repair work was obtained by the Bureau for consumers. Consumer reaction to the statute and the Bureau appears to be favorable, as fifty-three percent were satisfied with the Bureau's handling of their complaint and eighty percent said they would contact the Bureau again.[38]

The recovery of $659,000 would seem to provide some indication of the statute's success. Although a recovery of $659,000 at a cost of $3,800,000 (Bureau's expenses) may not seem cost effective, the very existence of the law probably prevents a large amount of overcharging, unneeded repairs, and fraud.

The question of mechanic competence is not addressed in the California law, as there is no provision for licensing of mechanics. Michigan has, however, addressed this question.

4.2.4.3 Consumer Protection Laws in Michigan - Michigan's law, with some minor differences, accomplishes what California law does, but in addition requires that mechanics be certified in order to perform automobile repair and maintenance. A mechanic may become certified in any or all of eight different categories (engine repair, auto transmissions, manual transmissions and rear axle, front end, brakes, electrical, heat and air conditioning, and tune-up). A "speciality mechanic" is certified in one to seven categories, while a "master mechanic" is certified in all eight categories. Each repair facility must have at least one mechanic certified in the types of repair it offers, and if work is performed by a non-certified mechanic, it must be inspected and approved by a certified mechanic. After December 31, 1980, all mechanics must be certified. To become certified, an applicant must apply, pay a fee, and pass an examination. Under the statute, the administrator is required to establish a program for training mechanics. Persons may apply for mechanic trainee permits which allow them to work for two years prior to their certification under the direct supervision of a certified mechanic. Exemptions from certification include full-time employees of auto manufacturers, do-it-yourselfers, and mechanics employed by a single commercial, industrial, or governmental establishment (or two or more under common ownership), who perform repairs only on that establishment's fleet.

The Michigan mechanics licensing law has been criticized on several grounds, but perhaps the most valid criticism is that the certification exam is too easy. Fifty percent is the passing score for each of the eight tests. In addition, no experience is required to qualify for taking the exam. NIASE has called the tests "Mickey Mouse."[39]

4.2.4.4 Effect of State Laws - The effect of existing state laws on the I/M/R Trade Group depends on the type of law. Disclosure laws increase the amount of administrative work for all members of the Trade Group in that estimates must be made in writing, customers must be contacted if repairs will exceed estimates, and records must be kept for a number of years. In addition, parts must be shown or returned to the customer. This burden, however, does not appear to be so excessive that it would put repair shops out of business or prevent new entries.

Nor would it appear to affect some Trade Group members significantly more than others. Disclosure law requirements appear to be just good business practice that a responsible repair shop would follow even in the absence of a law. Many repair shops have met and continue to meet disclosure requirements in the absence of any law.

Facility licensing laws usually require the repair facility to file an application and pay an annual fee. The licensing law can be used by the state to prevent the facility from doing business if the facility violates the law. The fees are usually reasonable ($50 per year in California) so the effect on all repair facilities or on one trade channel versus another would appear to be minimal.

Mechanics licensing laws could have an effect on the I/M/R Trade Group as a whole, and possibly different effects on its various members. If the competency requirements for licensing were high, large numbers of existing mechanics might be excluded, making an existing nationwide mechanic shortage worse. With mechanics in even shorter supply, stronger trade channels such as dealers and mass merchandizers would be able to retain more mechanics than independent garages, non-franchised specialty shops, and individual gas service stations. So far, however, the state laws passed have avoided these problems by exempting all existing mechanics from licensing requirements through "Grandfathering" (Hawaii) or allowing a number of years, or a grace period, before mechanics must become licensed (Michigan). In addition, licensing test requirements do not appear to be so high as to exclude large numbers of applicants. Even if a large number of states required mechanic licensing, it is believed they would follow the lead of Hawaii or Michigan and major disruptions in the I/M/R Trade Group, as a whole or among members, would not occur.

4.2.4.5 Proposed Federal Action - Federal involvement in auto I/M/R regulation has been explored by at least two Federal agencies, the FTC and NHTSA of the DOT. The proposals in the FTC document involve Federal funding for state and local regulations that would be similar to the three types of existing state laws. The effect on the auto I/M/R industry would probably be the same as discussed above for existing state laws.

A separate item in the FTC proposal, and one that NHTSA has also proposed, is the establishment of a nationwide system of diagnostic motor vehicle inspection stations which would inspect for safety, emissions, noise, and fuel economy, and would in addition, provide consumers with a list of needed repairs. Inspection for emissions and safety is already mandated by Federal law. The consumer protection aspect of this proposal consists of the unbiased detailed repair information provided to the consumer, allowing him to deal knowledgeably with repair shops. This would supposedly reduce fraud, incompetent diagnosis of faults and improper auto repairs. Support for this system has undoubtedly evolved from the five Federal Government experimental diagnostic centers that were mandated by Title III of the 1972 Motor Vehicle Information and Cost Savings Act and operated from March, 1975 through June, 1976.

If this system were implemented, it could possibly impact the entire I/M/R Trade Group and the relative positions of the Trade Group members. With the knowledge of defects received from the diagnostic centers, owners would presumably be more likely to perform maintenance and repairs that had previously gone undetected. This would tend to increase the aggregate amount of I/M/R performed. Shifting of market shares or the prevention of predicted shifting might also take place among the group members. For example, it is presently thought that "small garages" (independent garages, auto supply stores, and gas service stations) will not have sufficient capital to purchase the test equipment required for the diagnosis of sophisticated electronic systems. With a national diagnostic system, "small garages" would conceivably not need their own diagnostic equipment, and could, therefore, maintain their share of the I/M/R market. The Automotive Service Council, which represents independent repair facilities, appears to support this conclusion through their advocacy of a nationwide diagnostic system.[40]

The above analysis depends heavily on the particular mode of operation of the nationwide diagnostic system. Specifically, important are the degree to which the system will become mandatory and its cost (how much and paid by whom). If the diagnostic portion of an annual mandatory inspection were optional at standard industry rates, many owners would probably not have it performed. Even with diagnostic information, there is no assurance that owners would have the diagnosed repair and maintenance performed, and even if performed there would be no assurance without reinspection that all indicated procedures have been properly carried out.

Before implementation of a nationwide system of diagnostic inspection, it should be determined whether it will protect consumers. There is no conclusive evidence that such a system would accomplish this. Data on vehicle reinspection failure rates from the five Federal Government experimental diagnostic centers show that failure rates were about the same for treatment and control groups (control groups received only pass/fail information while treatment groups were given pass/fail plus diagnostic information and counseling).[41] There may have been some leakage of diagnostic information to control groups, however. Where concerted efforts were made to prevent leakage at one of the centers, there was a statistically significant difference (40 percent reinspection failure for the treatment group and 47.7 percent for the control group). Another study[42] concluded that there was no significant difference in successful repair rates between a control group and a diagnostic group (control group given general information about condition of their vehicles while diagnostic group given detailed technical data). The study did find, however, that if repair hint booklets were given to car owners, the success rate increased significantly for both groups.

A related study[43] found that during the first 16 months of the diagnostic Inspection Program unwarranted brake repairs decreased from 32 percent to 22 percent, and unwarranted engine repairs decreased from 41 percent to 22 percent. The final report of that study[44] reached the following conclusions:

Based upon the local environment and the study of 1968 through 1973 model year vehicles, diagnostic motor vehicle inspection appears cost-effective in that:

1. The unnecessary repair rate for critical systems was reduced in half -- from 26 percent of the critical repair actions to 13 percent -- with some unknown amount of useful life remaining in the replaced component.

2. The annual repair cost savings per vehicle for only two systems, brakes and engine, is estimated to be a minimum of $19. (The maximum possible cost savings may be as much as $58 per year per vehicle).

3. The accident rate is reduced significantly.

Counterbalancing these benefits is the estimated cost of inspection of $15 per vehicle. However, these conclusions must be tempered by the facts that:

1. Local conditions may not be representative for the nation as a whole.

2. A revolution in vehicle design is occurring, with a shift to subcompacts and compacts. The 1968 through 1973 model years studied do not represent today's

vehicles or the car of the future. The impact of downsizing and other technological advances on vehicle repair costs is too uncertain to predict with confidence.

In obtaining an independent third party diagnosis, the consumer does have an alternative to a nationwide diagnostic system (at least if he lives in certain areas). The alternative is the diagnostic centers described earlier (AAA and others).

Another alternative, one which is often overlooked, is the capability of many service outlets within the I/M/R industry to provide comprehensive vehicle diagnosis. Automobile and equipment manufacturers are deeply involved in the development of diagnostic programs, including special equipment, literature and training for diagnosticians. Many qualified retail service outlets perform diagnostic services at nominal fees, giving the consumers the option to have repairs performed at a place of their choice.

In terms of national priorities, state governments should use their available resources for the implementation of a national uniform periodic motor vehicle inspection program, which monitors adherence to Federal standards. Vehicle diagnosis should continue to be the responsibility of the I/M/R industry. Given such a national PMVI program in combination with further improvements of the I/M/R industry's diagnostic capabilities, the consumer's interests will be more than adequately protected.

5. EUROPEAN I/M/R INDUSTRY

The purpose of this section is two-fold: to describe the nature of foreign I/M/R industries and to investigate the major differences between domestic and foreign industry practices.

The majority of the information contained in the following four sections was collected in the course of a visit to West Germany and Sweden by two members of the project team. These visits involved discussions with high-level officials of selected vehicle manufacturers concerned with automobile development, manufacturing, and marketing; associations responsible for the training of service personnel; and organizations operating and administering periodic motor vehicle inspection programs.

The visits were limited to two countries for reasons of time and budget. West Germany and Sweden were selected because their approaches to automobile service and inspection systems appeared to be particularly well-developed and respected.

5.1 STRUCTURE OF WEST GERMAN I/M/R INDUSTRY

The information contained in this section is based on the I/M/R industry in West Germany. Analysis of network statistics and consumer surveys indicate similar trends in Switzerland, Austria, and in the Benelux and Scandinavian countries. The accelerating political and economic integration of European countries is the reason for these congruent service industry developments.

5.1.1 Service Network and Relative Contribution of Trade Groups

The major forces in the West German I/M/R trade group are new vehicle dealers, independent general garages, and gas service stations. Specialty repair shops are trying to enter the market with only moderate success. Table 5-1 provides that country's 1978 base data on the number of outlets, service capacity, and equipment investment for the major trade group members, as well as an analysis of their relative network contributions.

The column "Vehicles Serviced per Day" indicates the strong position of new vehicle dealers in the I/M/R market. A major reason for this development is the auto manufacturer's strong emphasis on service.

The dealer networks of the leading auto manufacturers are relatively dense. An analysis of the largest organization shows 3,414 franchised outlets for West Germany, an area approximately the size of California. Franchises fall into two categories: new vehicle dealers and authorized workshops. By authorizing small garages, most manufacturers are well-represented in rural areas. Table 5-2 provides a five category breakdown of one manufacturer's network in 1978, based on size of workshop and average daily number of repair orders. About 65 percent of workshops in this particular network have 1 - 5 workstalls, and handle a maximum of 15 repair orders per day.

5.1.2 Maintenance and Repair Mix by Trade Group Members

A survey of West German motorists conducted in 1976 by the Institut Fuer Technische Betriebsfuehrung im Handwerk (ITB), Karlsruhe, provides a breakdown by major maintenance and repair categories and shows the relative market share of each member of the trade group, including do-it-yourselfers. The results of this survey are summarized in Figure 5-1, which again underlines the relative strength of franchised dealers. Another notable point is the strong showing of the do-it-yourself segment in the market, which includes those who perform work "with the help of a friend."

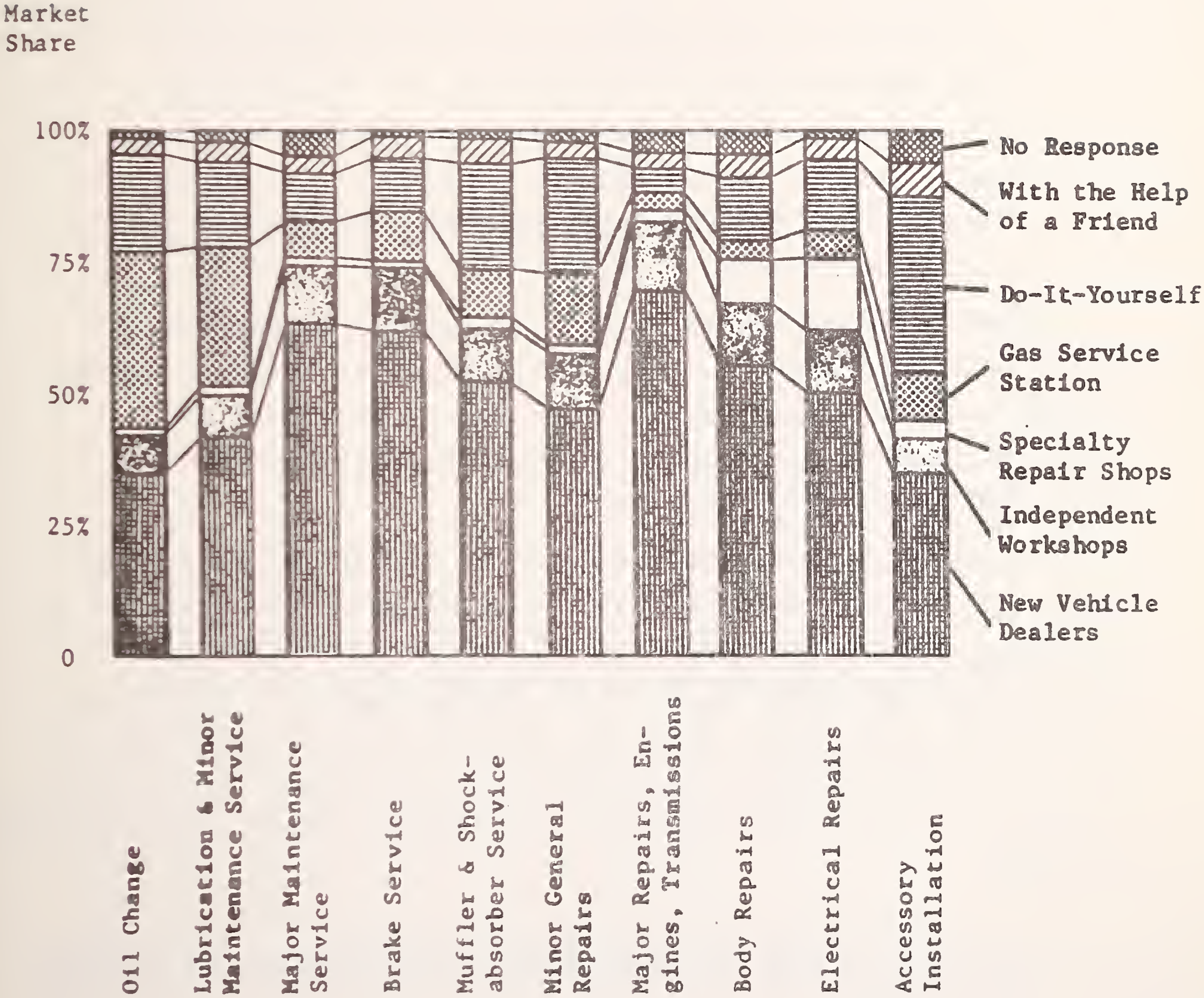
TABLE 5-1. CONTRIBUTION OF I/M/R TRADE GROUP MEMBERS TO THE SERVICE NETWORK IN WEST GERMANY (1978)

Trade Group Member	Number of Service Outlets		Average # of Vehicles Serviced per Day		Number of Workstalls		Number of Technicians and Apprentices		Value of Tools and Equipment (Million $)*	
	Total	%	Total	%	Total	%	Total	%	Total	%
New Vehicle Dealers	20,499	41	160,000	66	135,400	68	200,600	73	1,525	69
Independent General Garages	9,863	20	33,300	14	23,200	11	44,000	16	261	12
Specialty Repair Shops	1,619	3	9,250	4	6,850	3	5,000	2	77	3
Gas Service Stations	17,760	36	37,583	16	35,520	18	26,640	9	355	16
Trade Group Total	49,741	100	240,133	100	201,020	100	276,240	100	2,218	100

* Based on 1978 average exchange rate of $1 = DM2

TABLE 5-2. SERVICE NETWORK OF ONE WEST GERMAN AUTO MANUFACTURER - BREAKDOWN BY NUMBER OF WORKSTALLS (1978)

# of Workstalls	Average # of daily Repair Orders	# of Dealers	%
1 - 5	1 - 15	2,208	65
6 - 10	16 - 30	780	23
11 - 20	31 - 60	353	10
20 - 40	61 - 120	70	2
> 40	> 120	3	< 0.1



Source: Institut fuer technische Betriebsfuehrung im Handwerk, 1976

FIGURE 5-1. BREAKDOWN OF REPAIR AND MAINTENANCE OPERATIONS BY TRADE GROUP MEMBERS IN WEST GERMANY (1976)

5.1.3 Market Share Trend of Trade Groups, 1970 - 1978

According to various research reports, the West German aftermarket is undergoing these changes:

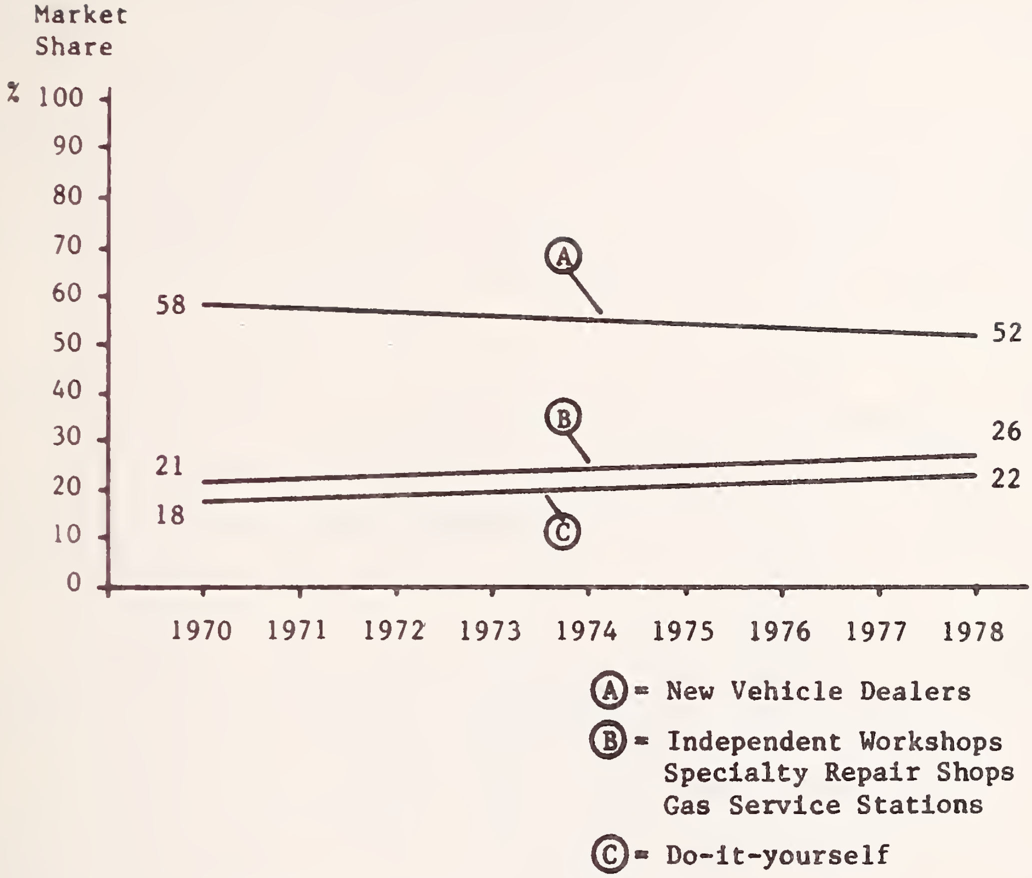
- An increasing percentage of vehicle owners use franchised dealers only for the performance of complex repairs.
- As vehicle age increases the frequency of visits to authorized workshops drops, while the share of the do-it-yourself segment increases.
- The trend to parts and component replacement rather than repairs continues. As a result, more independent and special workshops perform these relatively simple labor operations.

These changes are the result of the increasing cost of vehicle ownership, and a change in attitude of the West German motorist. As is the case in the United States, cars are becoming a functional mode of transportation and are losing their importance as status symbol.

Figure 5-2 indicates the shift of market shares during the period of 1970 - 1978, based on total labor and parts sales. Noteworthy is the slow but steady increase of independent organizations and the do-it-yourself segment at the expense of franchised dealers. As a countermeasure, auto manufacturers and their dealer network, operating from a position of relative strength, are actively involved in consumer-oriented modernization programs.

5.1.4 Structure of Service Personnel, Recruitment, and Training Activities

5.1.4.1 Structure of Service Personnel (1978) - At the end of 1978 franchised dealers, independent garages and specialty repair shops in West Germany employed 384,300 people, of which



Source: Volkswagenwerk A.G.

FIGURE 5-2. MARKET SHARE TRENDS OF THE WEST GERMAN TRADE GROUP (1970 - 1978)

225,800 were technicians and technical apprentices. Table 5-3 shows a breakdown of this service personnel by job classification. A more specific breakdown into typical service personnel categories in the West German dealer network (1978) is provided in Table 5-4. It should be noted that the dealer network under study employs one (1) apprentice for every 1.15 technicians (including bodymen). The relative high number of so-called "unproductive" employees (not billed directly) is partially due to the inclusion of 13,759 apprentices in their first and second year.

5.1.4.2 Recruitment of Service Personnel - The main source for service personnel is the West German national apprentice system. The auto service industry has maintained over the past decades a ratio of about one apprentice for every technician employed.

Service managers, shop foremen and service advisers are usually required to be master technicians (Meister). In order to qualify as master technician, the applicant must have worked for three years as technician. During this time the applicant must have either attended evening classes three times a week for two years, or have been enrolled in a special full time, one-year Meister Course.

Any automobile workshop must be under the supervision of a master technician in order to qualify for the employment of apprentices.

Figure 5-3 illustrates the duration of the educational process, the average age at which people may move to the next level, and career opportunities.

The magnitude and development of West Germany's apprentice program as the major source for automotive service personnel is illustrated in Figure 5-4 for the years 1963 through 1978.

TABLE 5-3. BREAKDOWN OF SERVICE PERSONNEL IN WEST GERMANY (1978) - Franchise Dealers, Independent Garages, and Specialty Repair Shops

Classification	Number of Employees	% of Total
Active Owners (dealers, workshops)	33,400	8.7
Active Family Members	5,400	1.4
Service Managers with Hourly Pay	10,000	2.6
Technical*& Administrative Employees	69,950	18.2
Administrative Apprentices	17,050	4.4
Technicians, including Bodymen	133,251	34.6
Technical Apprentices	92,549	24.1
Helpers	22,700	5.9
Total	384,300	100.0

*Service Advisers, Shop Foremen, etc.

Source: Zentralverband des Kraftfahrzeug Gewerbes e.V.

TABLE 5-4. SERVICE PERSONNEL BREAKDOWN OF WEST GERMAN FRANCHISED DEALER NETWORK (1978)

Category	Productive	Unproductive	Total
Service Managers		1,114	1,114
Shop Foremen (Meister)		3,063	3,063
Service Advisers		2,708	2,708
Administrative Personnel		7,451	7,451
Technicians, Bodymen, Painters	23,436		23,436
Apprentices (technical)			
1st year 6,710		6,710	
2nd year 7,049		7,049	
3rd year 6,678	6,678		
Total Apprentices 20,437			20,437
Total	30,114	28,095	58,209

Source: Volkswagenwerk A.G.

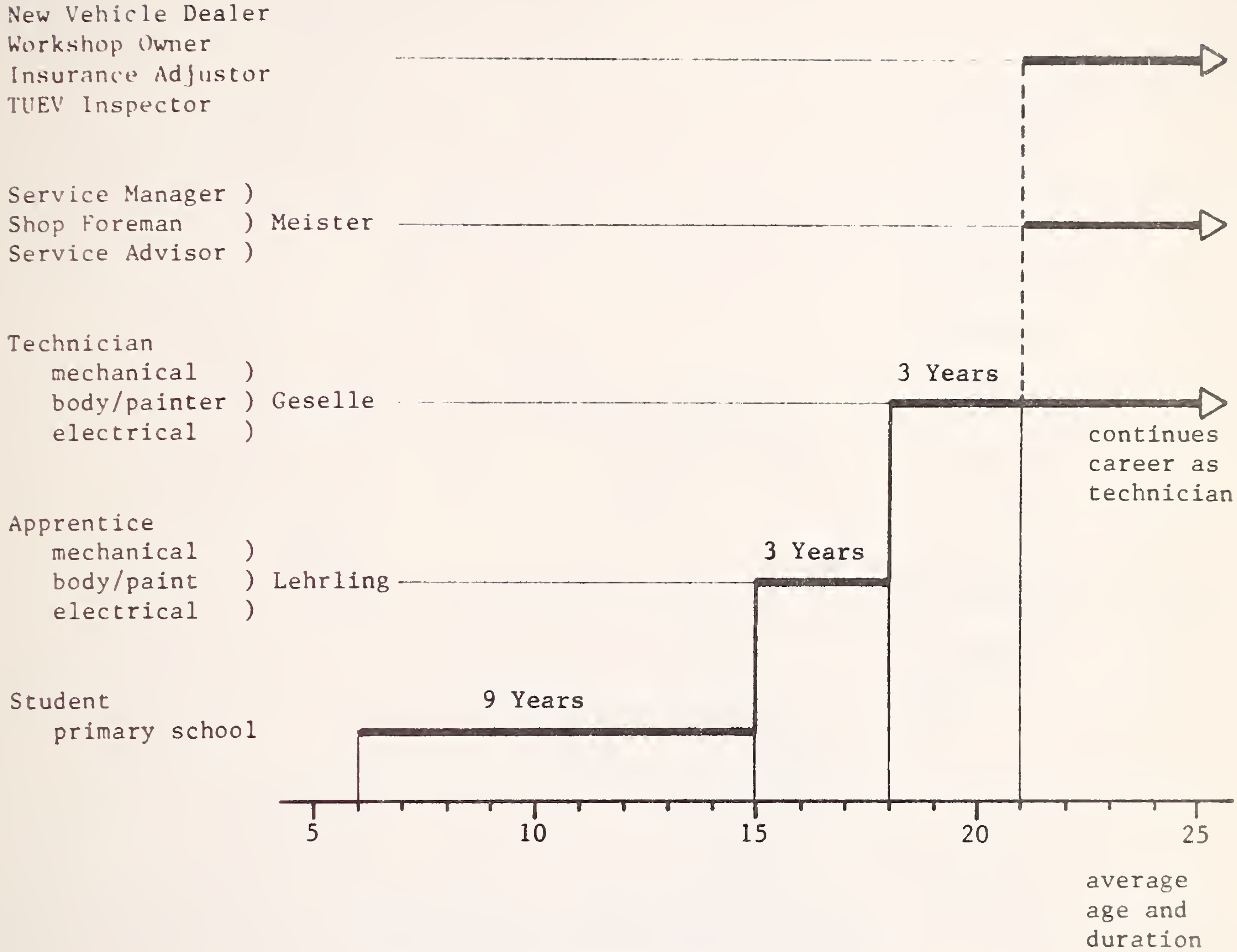
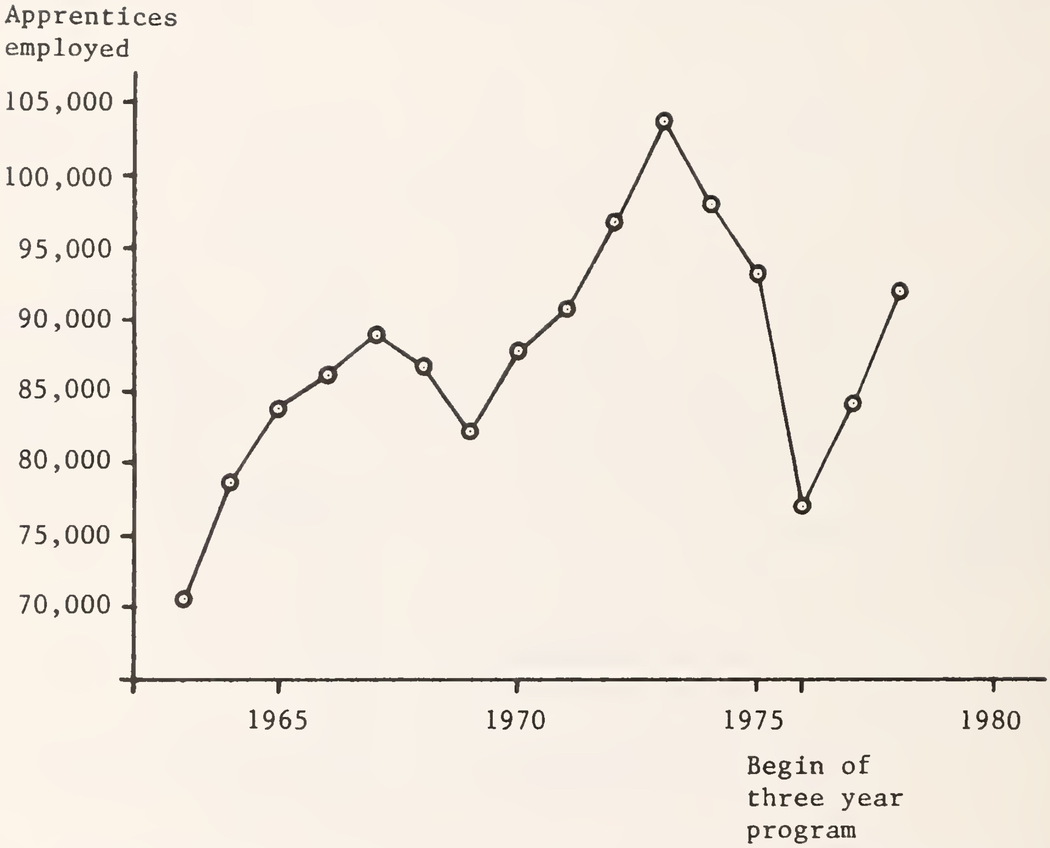


FIGURE 5-3. EDUCATIONAL PROCESS AND CAREER OPPORTUNITIES, WEST GERMAN SERVICE PERSONNEL



Source: Zentralverband des Kraftfahrzeug Gewerbes e.V.
Institut fuer technische Betriebsfuehrung im
Handwerk

FIGURE 5-4. MAGNITUDE AND DEVELOPMENT OF WEST GERMAN APPRENTICE PROGRAM, 1963-1978

The increase in the number of apprentices employed beginning in 1976 is attributed to the reduction of the training term from a 3 ½ to 3 years.

5.1.4.3 Training Activities - All trades are subject to a Job Classification System, administered by the German Federal Government. The category "Automotive Technician" (Kraftfahrzeug Mechaniker) falls, like any other profession, under requirements pertaining to:

- duration of apprenticeship
- required skills and knowledge
- training requirements
- examinations.

Table 5-5 shows in abbreviated form the program outline and duration, based on paragraph 5 of "Regulation for the Professional Training of Automobile Technicians," issued December 11, 1973 by the Ministry of Economy.

During the entire three-year period apprentices learn about on-the-job safety and health. Attendance at a vocational school one full day per week and the performance of weekly home assignments are mandatory. An equally detailed training program exists for "Automotive Electricians."

The automotive apprentice program is the most popular category among graduates of primary schools. As a result, applicants outnumber available apprentice positions, giving employers an opportunity to select the best suitable students.

The job profile for automotive technicians is being periodically updated in line with changing automotive technology. This adaptation process is a joint effort of the manufacturers, industry associations, trade guilds, and educational institutions.

In 1978, dealers and workshops paid collectively DM 481

TABLE 5-5. OUTLINE AND DURATION OF THE WEST GERMAN AUTOMOTIVE APPRENTICE PROGRAM

Subject	Duration
Metalworking, including: measuring filing, sawing, chiseling, shearing, riveting, drilling, straightening, thread cutting, turning, soldering, welding, maintaining tools and equipment	approximately 7 months
Test Methods, including: mechanical, electrical, hydraulic	approximately 9 months
Maintenance & Repair Techniques, including: lubrication, suspension, brakes, electrical, body assembly, engine, transmission	approximately 20 months
Special Engine Repair, including: precision measurement techniques, overhaul methods	

Source: Bundesgesetzblatt, Der Bundesminister fuer Jugend, Familie und Gesundheit, 1973 million ($253 million) for apprentice training. This amounts to a direct annual cost per apprentice of DM 5,200.00 ($2,735.00). Apprentices earn an average of

DM 300.00 ($158.00) per month during the first year

DM 350.00 ($184.00) per month during the second year

DM 400.00 ($210.00) per month during the third year.

Figures vary plus/minus 15 percent based on local wage structures. During the second and third years, dealers and workshops are permitted to charge for certain labor operations performed by apprentices. This income is not reflected in the above stated annual cost per apprentice.

West Germany's vocational school system is financed through government funds. The total annual government expenditure for automotive related apprentice training is estimated at DM 77.5 million ($40.1 million). This figure is based on 93,000 apprentices, one school day per apprentice per week, 40 training weeks per year, 30 students per class, and DM 100,000 ($52,631.00) of fixed cost and teacher's salary per year.

While the apprentice program represents the major source of qualified tradesmen for all professional trade groups, the category "Meister" (master) is of equal importance. Educational requirements are high, and enrollment and pass rates at first attempt are relatively low as shown in Table 5-6.

The title "Meister" (master) is synonymous with high skill level and thorough theoretical knowledge. The title holder is held in high esteem within German society.

While the apprentice system must be considered the basis of automotive training, considerable continuing education is provided for all service personnel categories. The major sources for these educational services are the manufacturers of vehicle and vehicle subsystems.

TABLE 5-6. GRADUATION OF MASTER TECHNICIANS (MEISTER) IN WEST GERMANY 1954 - 1977

Year	Enrolled	Passed	Failed
1954	1578	1338	15.2 %
1960	2316	2034	12.1 %
1965	4166	3605	13.5 %
1970	5306	4197	20.9 %
1973	6191	4391	28.9 %
1975	5389	3785	29.7 %
1977	4291	3041	29.1 %

Source: Zentralverband des Kraftfahrzeug Gewerbes e. V.

Training is offered in the areas of workshop management and administration, as well as in product related technology. Methods of training are classroom lectures, in-house training and home courses. The manufacturers' training activities are supplemented by courses conducted by trade associations and local chapters of the trade guilds.

The major association of the German auto retail industry, "Zentralverband des Kraftfahrzeug Gewerbes e.V." maintains and operates the "Academy for Automotive Management". This institute conducted 347 seminars with 10,955 participants in 1977.

The following overview of the seminars and courses offered by one auto manufacturer characterizes the variety and depth of service related training efforts:

OWNER/GENERAL MANAGER

Seminar	1	Basic Business Management
Seminar	2	Advanced Business Management
Seminar	3	Management Techniques
Seminar	4	Group Dynamics
Seminar	5	Rhetoric (public speaking, debate)
Seminar	6	Service Management

SERVICE MANAGER

Seminar	1	Basic Business Management
Seminar	3	Management Techniques
Seminar	4	Group Dynamics
Seminar	5	Rhetoric
Seminar	7	Workshop Management
Seminar	8	Workshop Organization

SHOP FOREMAN, SERVICE ADVISER, ADMINISTRATIVE PERSONNEL

Seminar	9	Customer Relations
Course	1	Technical Topics for Service Advisers
Seminar	10	Service Administration

SHOP FOREMAN, TECHNICIAN

Course	2	General Repair (3 types)
Course	3	General Repair (5 types)
Course	4	General Repair (1 type)
Course	5	Electrical
Course	6	Otto Engines
Course	7	Diesel Engines
Course	8	Ignition and Fuel System
Course	9	Fuel Injection
Course	10	Transmission/Drive Train (3 types)
Course	11	Transmission/Drive Train (5 types)
Course	12	Transmission/Drive Train (1 type)
Course	13	Repair of Electrical Components
Course	14	Bodyshell (basic)
Course	15	Bodyshell (advanced)
Course	16	Paint Techniques (basic)
Course	17	Paint Techniques (advanced)

INDEPENDENT WORKSHOP TECHNICIANS

Course	18	General Maintenance and Repairs

The same company showed classroom training activities for 1978, as detailed in Table 5-7.

During 1978 the same auto manufacturer's dealer organization conducted in-house training for 3,414 dealers and authorized workshops, with about 60,000 employees attending close to 6,000 sessions.

5.2 EUROPEAN INSPECTION, MAINTENANCE, AND REPAIR TECHNOLOGY

5.2.1 Maintenance and Repair Methods

Developments in this field are inseparable from the automobile design itself. Most manufacturers place considerable emphasis, therefore, on the reduction of overall maintenance and

TABLE 5-7. AUTO MANUFACTURERS' SERVICE CLASSROOM TRAINING, 1978

Personnel Category	# employed	# trained	% of total employees trained
Management and administrative personnel	13,110	3,976	30
Technicians	23,436	15,228	65
Apprentices	20,437	on-going	100

Source: Volkswagenwerk A.G.

repair needs, improvements in diagnosability, reduction of time required to perform high frequency labor operations, and a general lowering of repair complexity levels. Some companies have made considerable progress in this field. For them, lowering the maintenance and repair requirements of their products has become an important part of their marketing strategy.

For many years, certain manufacturers have performed detailed studies on the frequency of labor operations performed on their cars. Based on this exact knowledge of the volume and mix of service transactions, specific maintenance and repair methods are being applied today throughout the German service industry. Key approaches are outlined below.

5.2.1.1 Vehicle Diagnosis - The need to diagnose vehicle faults prior to performing repairs has long been recognized. Service networks have made considerable investments in diagnostic equipment. Dynamic testing of engines, transmissions, drive-trains, and brakes is standard procedure in most medium and large size operations. Table 5-8 indicates the 1975 average investment in test equipment in relation to the total value of shop equipment typical for West Germany.

Most manufacturers of sub-systems, such as electronic fuel injection, develop compatible test equipment simultaneously with sub-system development. Computerization of equipment, featuring automated test sequencing, test evaluation and result printouts, is making steady progress. In addition, sensors and transducers for on-and off-board diagnosis are being introduced on selected models. However, cost considerations and reliability are still limiting factors.

In recent years, technical literature has undergone basic changes too. Most manufacturers now provide detailed guidelines for failure analysis and identification of malfunctioning parts.

TABLE 5-8. AVERAGE TEST EQUIPMENT INVESTMENT BY WEST GERMAN WORKSHOPS (1975) - BREAKDOWN BY BODY SHOP SIZE

Workshop Size	Value of total Workshop Equip. ($)	Value of Test Equipment ($)	Test Equipment as % of total Workshop Equip.
4 Workstalls	47,000.00	19,500.00	41
8 Workstalls	79,000.00	24,000.00	30
16 Workstalls	156,000.00	41,000.00	26
25 Workstalls	217,000.00	55,000.00	25

Source: Institut fuer technische Betriebsfuehrung im Handwerk

5.2.1.2 Maintenance - So called preventive maintenance, as recommended by the manufacturers, represents a major part of the total service business. Vehicle owners generally recognize the value of regular vehicle checks as a means to reduce overall repair costs and unexpected failures. Based on statistics from one major service network, maintenance service accounts currently for 31 percent of the daily number of customer repair orders, and 21 percent of customer labor sales. ADAC (Allgemeiner Deutscher Automobil Club) indicates that of all service transactions, 32 percent fall into the category of factory recommended maintenance.

Since maintenance services are predictable "packages" of certain labor operations, their frequency, time requirements, and complexity are well-known factors.

As a consequence, auto manufacturers have (as early as the mid-fifties) developed special work areas for the performance of maintenance services. Based on the daily volume of a given workshop, 2, 3, or 4-person teams work on the same vehicle at the same time. Using time and motion studies, specific operations are assigned to each technician. Special tools and equipment (powered and overhead) and other time saving procedures have also been developed.

The resulting time reduction and improved quality of workmanship benefit both customers and workshop.

5.2.1.3 Express Service - This approach recognized the specific volume of short-time, high-frequency labor operations, such as brake or headlight adjustments and replacement of accessible parts like fan belts or light bulbs. Special areas within the workshop are set up for the performance of these operations, providing optimum tool and equipment layouts, parts supply, and operational controls.

Larger operations have installed separate Express Centers, handling all aspects of a typical customer transaction--reception, work distribution, work performance with parts supply, and invoicing with cashiering--in a single department. It combines the convenience, speed, and personal touch of a small business (service station, garage) with the resources of a major repair operation.

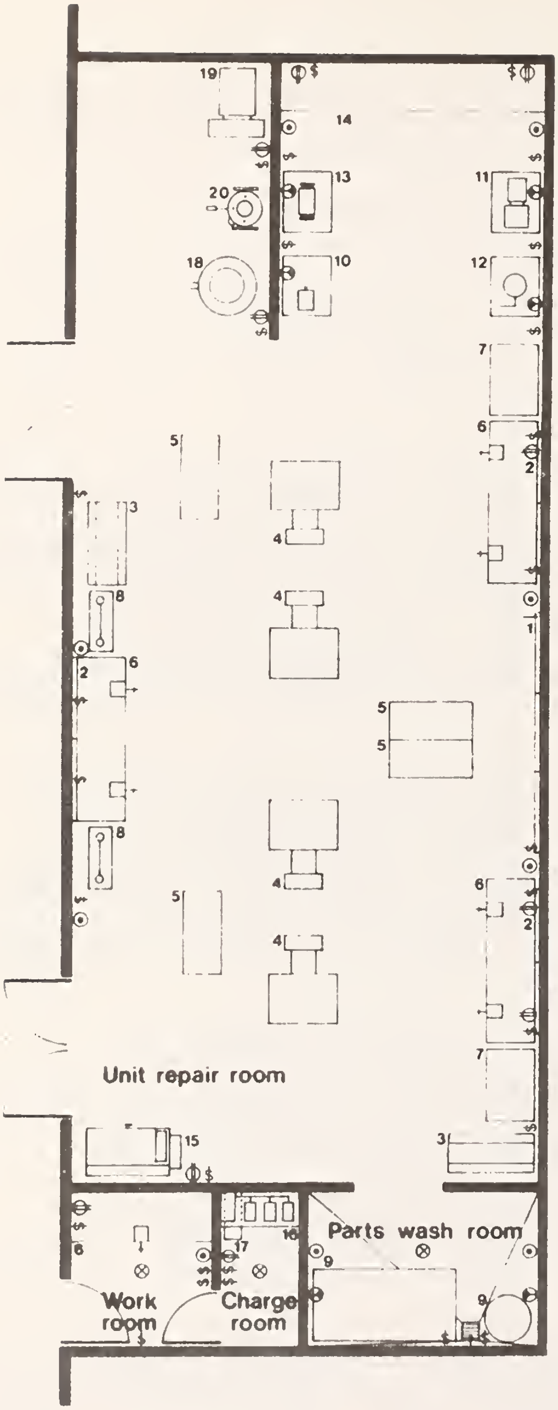
5.2.1.4 Repair of Vehicle Components - European vehicle design has for years emphasized the removal of certain sub-assemblies from the car, with subsequent repairs performed under optimum conditions, away from the workstall. Most noteworthy is probably Volkswagen's Beetle, which led to the original concept of so-called "Unit Repair Rooms".

While the current trend points towards exchanging sub-assemblies rather than repairing them, these special repair sections are still an important part of workshop layouts and operational concepts. Figure 5-8 depicts a typical unit repair room.

The arrangement of mounting stands for components, special tools, parts cleaners, and power outlets is based on time and motion studies. While the components are being repaired, vehicles are often removed from the workstall to permit better utilization of available shop capacity.

5.2.1.5 Body and Paint Repairs - Body and paint repairs are considered part (and the responsibility) of franchised dealers' service operations.

Automobile manufacturers provide comprehensive assistance in layout planning, equipment selection, repair techniques, business management, and promotional aspects. A series of corresponding training courses is regularly offered.



Equipment

1. Tool Board - Repair Stands
2. Tool Board - Workbench
3. Tool Trolley
4. Repair Stand
5. Parts Trolley
6. Work Bench
7. Tool Cabinet
8. Tool Press
9. Parts Wash
10. Valve Grinding Machine
11. Brake Drum Lathe
12. Drill Press
13. Bench Grinder
14. Work Shelf
15. Generator Test Stand
16. Charging Bench
17. Quick-Charging Equipment
18. Tire Changing Equipment
19. Wheel Balancing Machine
20. Brake Bleeding Equipment

Symbols

Compressed Air
Water Tap
Shop Outlet
Electrical Outlet
Switch
Mechanical Ventilation

FIGURE 5-5. UNIT REPAIR ROOM

This commitment to body repairs has a strong impact on vehicle design. Special design segmentation of body parts has led to the simplification, and thereby reduction, of body repair cost.

Close cooperation exists also between manufacturers and insurance companies as will be discussed in Section 5.4.

Outstanding features of body shops are:

- separation of body (metal) and paint sections
- efficiency of layouts
- application of hoists and special equipment
- availability and use of (mostly) pressurized spray booths
- modern management methods, including stringent controls
- cleanliness.

5.2.1.6 Summary - Manufacturers promote and continue to emphasize further specialization of workshop operations.

Related activities are based on in-depth studies of labor operation frequency.

The resulting broad application of skill groups improves training effectiveness, technicians' efficiency, and utilization of facilities and equipment. By applying direct costing methods, special services are prices individually, resulting in the reduction of maintenance and repair cost.

On-going improvements of vehicles from a service point of view focus on:

- increased maintenance intervals and a decrease of maintenance items
- increased life expectancy for parts and components

- reduction of labor operation complexity
- reduction of special tool requirements
- segmentation of body parts
- exchange systems for (sealed) vehicle components.

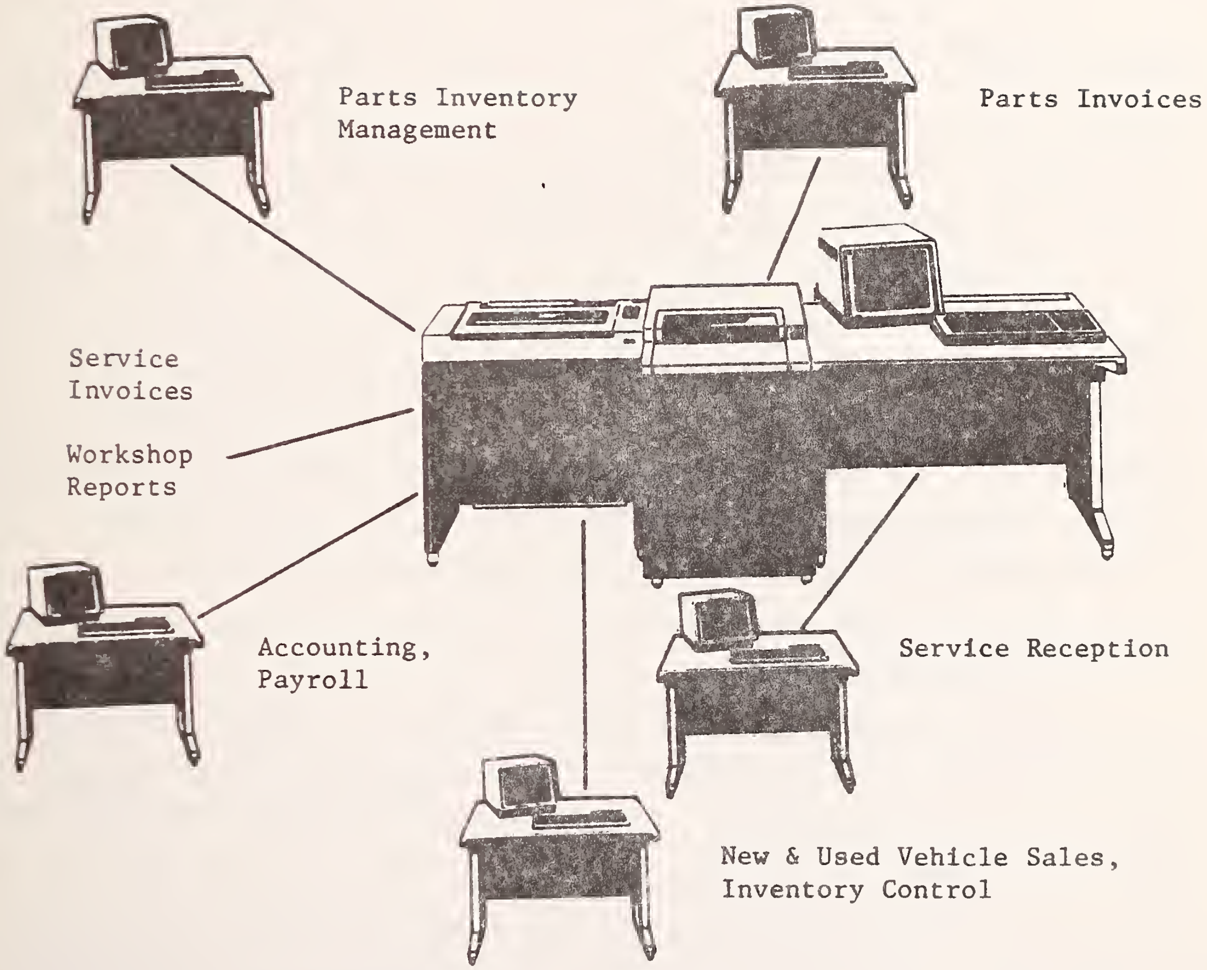
5.2.2 Automation of Administrative and Control Functions

As vehicles in operation increased from practically zero after World War II to the current 21 million, service volume increased proportionately. Workshop controls have been developed and applied throughout the service industry, mainly due to early initiative on the part of manufacturers. During the early days, workshops generally used special service reception procedures, scheduling systems, and time controls. Customer invoices were being prepared on typewriters and special invoice forms, and daily, weekly and monthly management reports were manually generated.

Against this background, automation of service and parts transactions was an obvious and logical step. As in the United States, the on-going development of data processing systems, combined with considerable price reductions, hardware and software, has made computer application feasible for a large number of dealers and workshops.

Current trends favor integrated in-house (dealer, workshop) installations, with interface capability to parent companies. The emphasis is on the elimination of manual input. Most of the commonly used systems provide means for automated invoice preparation with simultaneous data collection for accounting, parts inventory management, warranty claims administration, and vehicle/customer history files.

Figure 5-6 illustrates a multi-station system developed jointly by the computer and auto industries. This modular



Source: Volkswagenwerk A.G., Nixdorf A.G.

FIGURE 5-6. INTEGRATED DEALERSHIP DATA PROCESSING SYSTEM, FEATURING AUTOMATED SERVICE AND PARTS INVOICING WITH SIMULTANEOUS DATA COLLECTION system is available in "building blocks" for different size operations. The monthly equipment rental fee ranges from about $1,750.00 to $2,800.00, placing automation of service and parts within reach of a large number of service operations. Customer convenience and reduction in administrative costs are the direct benefits of this approach.

Automation of service and parts transactions, such as preparation or repair orders and estimates during the customer reception phase, determination of shop capacity and scheduling, time control, and the preparation of invoices, has found only limited acceptance in the United States I/M/R industry. Most existing applications are based on "stand-alone" systems, often developed by different computer companies. Existing know-how and hardware in this country is more than adequate to develop integrated systems for the I/M/R industry. This has been demonstrated by other retail organizations such as airlines, car rental companies, and department stores, which routinely utilize computers for daily business transactions.

5.2.3 Information Systems

As outlined in Section 3.1.2 and 3.1.3, members of the I/M/R support group provide the trade group with service-and parts-related information. This information can be divided into two groups:

Consumer Information, such as:
- owner manuals
- maintenance schedules
- warranty brochures
- dealer lists
- recall notifications

Dealer/Workshop Information, such as:
- diagnostic manuals
- maintenance and repair manuals

- labor operations manuals
- warranty policy and procedure manuals
- operational guidelines
- in-house training material
- technical and administrative bulletins
- parts catalogues, price lists

In most cases these publications are produced in many languages for the different export markets and specific buyer groups.

The cost of the development and production of service-and parts-related information depends mainly on the range of products and services offered. Auto manufacturers in Europe and the United States reported annual publication budgets ranging from 10 - 30 million dollars. Due to the development of new models incorporating new technologies, these financial expenditures have increased considerably over the years and will continue to do so. Some auto manufacturers, in cooperation with communications experts and hardware suppliers, are currently developing and/or introducing new methods for the processing and transmission of information.

In the area of generating the original information, such as technical manuals, parts catalogues, or owner manuals, some manufacturers are testing Text Management Systems. In Europe, computers are used for the establishment of repair times guidelines, resulting in speedy and accurate preparation of dealer manuals.

Various approaches for the two-way transmission of information between manufacturer and franchisees are currently being studied or field tested. One example is the use of "intelligent" terminals on the dealer level. In the past, these communication links have been used for vehicle and parts ordering, as well as for transmission of business management related data. Manufacturers are currently expanding these systems for warranty claim administration.

Future use of centralized technical data banks, accessible to members of the I/M/R trade group, is a distinct possibility. One United States manufacturer is testing a system using direct access via toll-free telephone lines from the field to its centralized vehicle master file. A workshop can thus verify, for example, whether a warranty or recall campaign repair has or has not been performed on a specific vehicle, no matter which dealership the vehicle is brought to.

Other means of information transmission, such as microfiche or videodiscs combined with computers, are among the approaches currently being studied by the industry.

It is generally recognized that the quality of work performed on the retail level depends to a large degree on the instant availability of current technical information. Unfortunately, research and development in the area of information generation and transmission is still fragmented. Since the I/M/R industry could greatly benefit from improved communication systems, joint ventures for the development of such systems should be encouraged.

5.3 FOREIGN GOVERNMENT CONSUMER PROTECTION AND INSPECTION SYSTEMS

The purpose of this section is to describe the motor vehicle inspection systems of selected foreign countries and to comment on other consumer protection methods adopted by these countries.

It became clear upon examination that there are considerable differences in the structure and organization of the foreign inspection systems. For example, in some countries inspection is performed by a government agency, in others by non-profit independents, in others by authorized repair garages. However, there is a strong trend among these foreign countries toward uniform inspection standards. There are already isolated cases where one country does not require reinspection of vehicles that were inspected in another country.

The efforts toward greater standardization and increased uniformity of procedures of motor vehicle inspection are coordinated by the International Vehicle Inspection Committee (Comité International de l'Inspection Technique Automobile, CITA, 163 rue Royale, 1030 Bruxelles). It was not possible to meet officials of this international organization during the European visit. Considering that the United States state inspection systems are not uniform (and in many cases either unproven or non-existent), the publicizing of the technical status, trends and international coordination of foreign inspection systems would seem to be very useful. The International Vehicle Inspection Committee should be able to provide much of the background information.

5.3.1 Structural Organization of Inspection Systems

5.3.1.1 Sweden -

The Inspection Agency

In Sweden, all motor vehicle and trailer inspections are performed by AB Swensk Bilprovning (Swedish Motor Vehicle Inspection Company) which is abbreviated as SB.[45, 46] SB was created in 1963 as a non-profit organization in which the Swedish government holds 52 percent of the shares. Other shareholders are the Royal Automobile Club, insurance companies and the National Swedish Association for Motor Retail Trades and Repairs. The capitalization of SB is approximately $215,000. Its expenses are covered exclusively by the inspection fees collected from the public. Gross revenue during the period of July 1, 1977 to June 30, 1978 was approximately 60 million dollars. The number of vehicles inspected during that period was 3.8 million and the total number of employees was approximately 2,000.

In 1978, SB became the National Testing Agency for motor vehicles, trailers and other highway vehicles. All technical testing and inspections, required by law for these vehicles, is carried out by SB, which also assesses observed defects in accordance with standards established by the National Swedish Road Safety Office of the Ministry of Transport.

Scope of the Inspection Program

The periodic inspection is a technical examination of the vehicle with the purpose of checking its traffic safety features against given standards. The legal basis for periodic inspection is the "Vehicle Act" which stipulates that all vehicles must be inspected and specifies the frequency of the inspections for various classes of vehicles.

Although the main purpose of the inspection program is related to safety, officials of SB pointed out that they had been unable to prove with the help of accident statistics that the program had in fact brought about a reduction of traffic fatalities and injuries. The reason for this is that other factors, such as increase in vehicle density, change from left to right hand driving, variation in speed limits, etc., also influenced the accident statistics. Despite this, it appears reasonable to accept that vehicles in good condition are less prone to cause or be involved in accidents.

Even though periodic inspections constitute its main task, SB also carries out type approval, voluntary inspections (such as checks of the condition of engines and transmissions) exhaust emission testing, certification of imported vehicles, and various other special tests required by law. The voluntary inspections of engines and transmissions allow the consumer to obtain an independent opinion on needed repairs and on the quality of repairs performed.

Apart from the inspection system, the consumer may complain about unsatisfactory repairs through various channels, including the Royal Automobile Club, the local consumer protection office, and its related claims court. This court settles almost all complaints by telephone. In those cases, where a settlement is not reached, the Association of Swedish Automobile Manufacturers and Wholesalers makes a settlement decision which is not legally binding on the repair shop but is usually followed.

5.3.1.2 West Germany -[47,48,49,50] The "Road Licensing Regulations" of 1937 contain as a discretionary clause the legal basis for the periodic inspection of vehicles by officially authorized experts. These regulations name as objects of inspection the steering system, brakes, lighting, tires, direction indicators, license plates and emission of noise and smoke. In 1951, this discretionary clause was changed to a regulation for compulsory inspection. The legal provisions concerning vehicle inspection at regular intervals have been promulgated by the Federal Minister of Transport with the approval of the Länder (States).

State Inspection Organizations

The States delegate the actual responsibility of inspection to the following bodies:

- TÜV (Technischer Überwachungsverein; Technical Inspection Association) in eleven of the States
- TÜA (Technisches Überwachungsamt; Agency for Technical Inspection) in two of the States
- DEKRA, a private profit-making inspection company.

By far the most important of these bodies is TÜV, and only its activities will be described below.

The German TÜV's are private, independent, self-financing, non-profit organizations operating in individual States (Länder). They are also independent of one another.

The TÜV's have performed their activities for 100 years. They were established in the last century by industrial enterprises to prevent the hazards incidental to the use of steam boilers. The government has recognized and approved the activities of the TÜV's and has stopped performing its own supervisory functions, delegating them to the TÜV's. In addition to steam boilers, the TÜV's are entrusted with inspecting and testing many other hazardous technical systems, including motor vehicles.

The TÜV's are inspecting and advisory bodies whose authorized inspectors carry out tests and examinations on behalf of plant owners, manufacturers and public authorities with the view to protecting man and property from possible hazards and to ensuring proper and efficient operations of the equipment in question.

Within the purview of highway traffic legislation, the TÜV's perform the following tests and inspections:

- type approval testing of motor vehicles and their accessories
- inspections of motor vehicles

- testing and examination of drivers and driving instructors
- compiliation of records of automotive defects, parts failures and related experience.

The eleven TÜV's of West Germany are incorporated into VdTÜV (Vereinigung der Technischen Überwachungsvereine; Confederation of Technical Inspection Associations) which has its seat in Essen. The principal aims of VdTÜV are:

- to deal with all supra-regional matters of its members
- to advise the pertinent Federal Government departments with respect to legislation and regulations
- to achieve the highest possible degree of uniformity in technical inspections throughout the Federal Republic
- to compile records of defects, parts failures and related experience and to make them available to all parties concerned in the form of appropriate publications
- to aid in the establishment of national standards.

5.3.2 Description of Inspection Network and Procedures

5.3.2.1 Sweden

Frequency of Inspection

Private automobiles are inspected once a year after the vehicle is two years old. Taxis, buses and trucks are inspected more often.

Inspection Network

The network consists of 170 inspection stations (including two mobile stations) with a total employment of approximately 2,000 persons, including clerical and administrative staff. The largest stations have a capacity of 400 vehicles/day. The yearly number of inspections is 3.8 million, including voluntary inspections, for a population of approximately three million passenger cars. The equipment is standardized throughout the network and consists of commercially available gear, usually with modifications, and special gear developed by SB and built to their specifications.

Nature of Inspection[45]

The functional breakdown of the vehicle along which the inspection process is organized is shown in Figure 5-7. The main emphasis is on safety. However, CO measurements at idle are now performed. SB is moving toward a more precise inspection of emission. A vehicle may also be rejected if it appears to be excessively noisy.

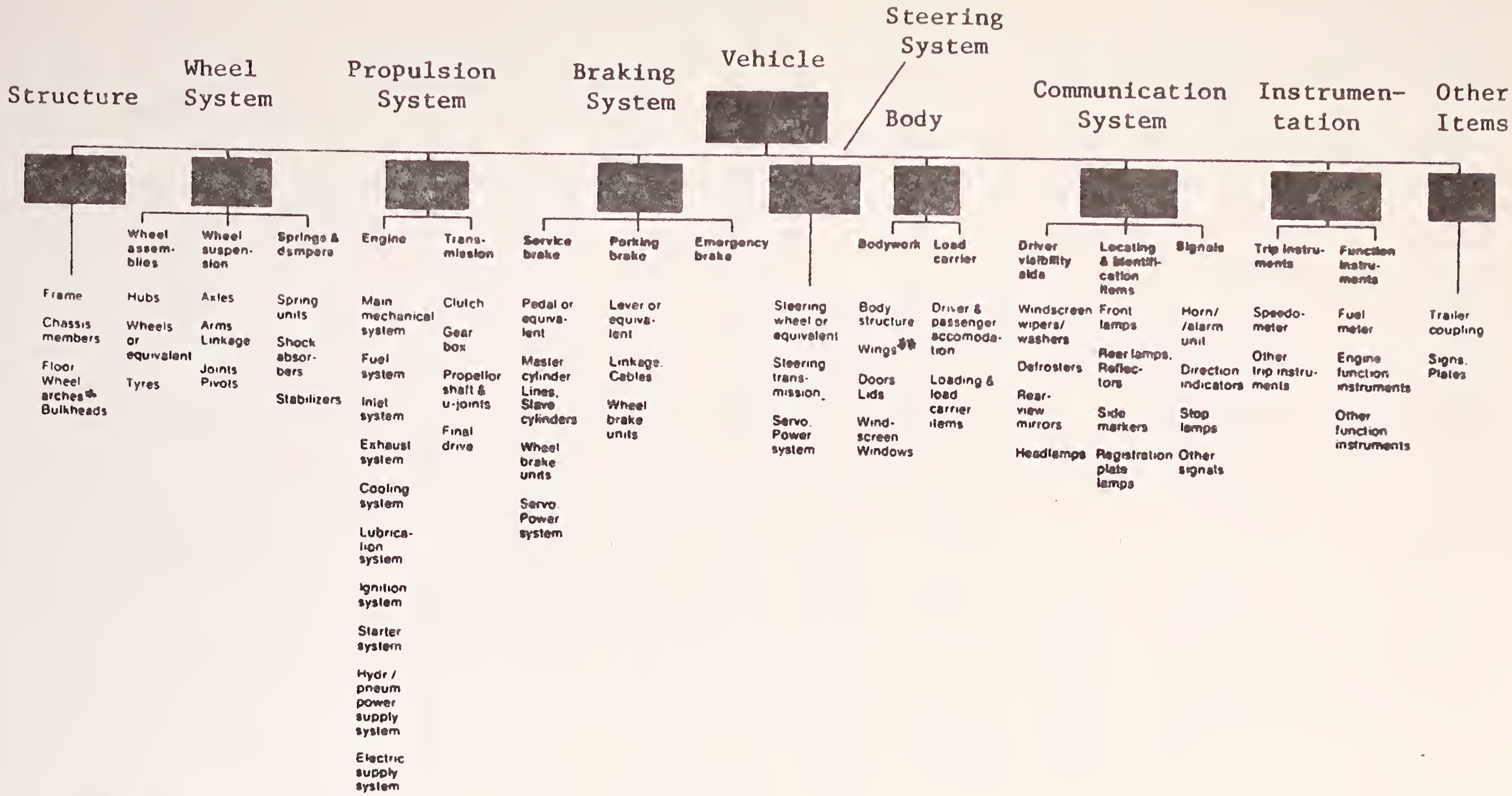
The total duration of the inspection is of the order of 15 minutes. It is performed sequentially at two inspection stations, each manned by one inspector. At the first station, the lights and the signalling equipment is checked visually and with the help of appropriate instrumentation. At the second station, the car is lifted up and checked for corrosion, wheel alignment, steering mechanism, tire pressure and emissions. Thereafter, the car is given a short driving test by the second inspector.

Depending on the size of the facility, there may be more than one parallel inspection station.

Enforcement Methods

To ensure that the cars are inspected with the required frequency, the yearly license plate sticker is not reissued unless the vehicle has successfully passed inspection. The same enforcement procedure is used to verify that the vehicle is insured.

If a vehicle fails the inspection because of a serious defect, the owner is served an injunction which forces him to have the car repaired and reinspected.



* Wheel wells
** Fenders
Source: Reference 45

FIGURE 5-7. FUNCTIONAL BREAKDOWN OF THE VEHICLE FOR PERIODIC INSPECTION IN SWEDEN

About 0.3 percent of the inspected vehicles fail and are prohibited from further use.

Cost of Inspection

The cost for a passenger car is $16.

Financial Data Pertaining to the Inspection System

Yearly gross revenue is $70 million, which is broken down as follows:

salary and fringes	$49 million
buildings (rent, cleaning)	$10.5 million
miscellaneous (mainly interest and equipment depreciation)	$10.5 million

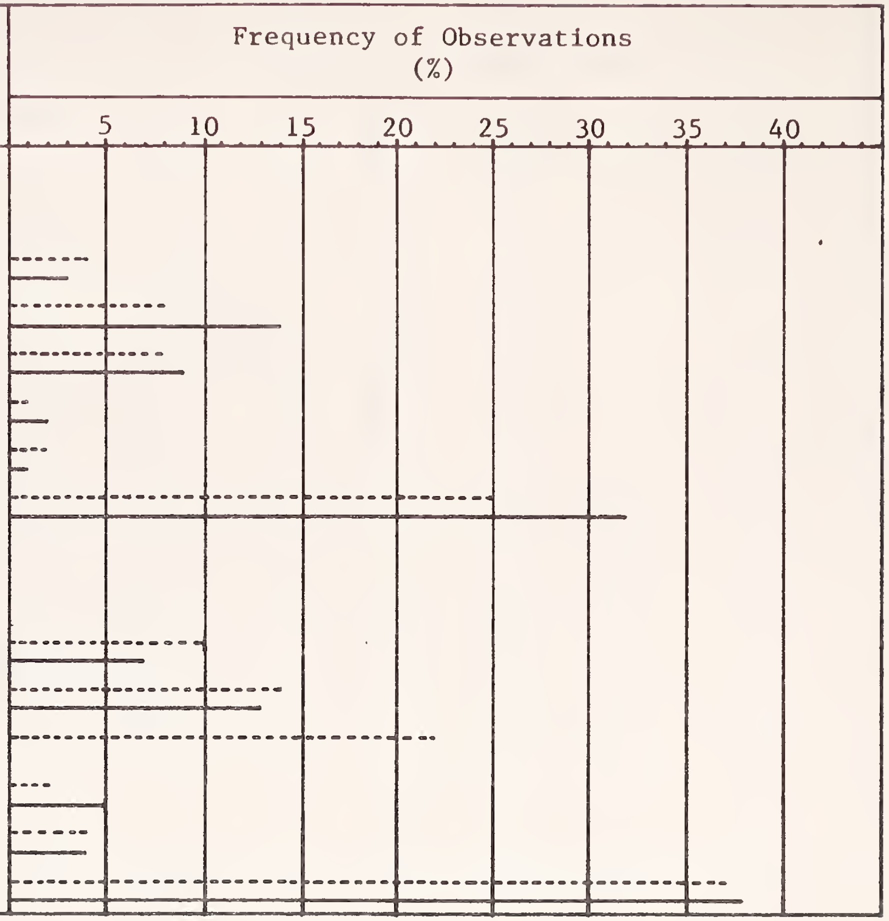
Publication of Inspection Results

SB is directed by the pertinent government authority to publish those results of its testing and inspection activities that are considered to be of general interest to the public. The annual statistical report "Weak Points of Cars (Reference 45) is based on the large amount of data derived from the periodic vehicle inspections. The display takes the form of relative observation frequencies of defects for different main systems and subsystems and for different makes. High observation frequencies of defects are considered to indicate weak points.

In a recent (1979) edition of this publication, covering 1978 and earlier model year vehicles, the weak points of each car are displayed in a format partially illustrated in Figure 5-8. The table shows defect observation frequencies for vehicles 2 years old (MY 1976), 4 years old (MY 1974) and 8 years old (MY 1970 - not illustrated).

"Actual" and "average" cars are defined as follows: the "actual car" is the make and year to which the display pertains; the "average car" is representative of all vehicles of

Main System	Average Car (----)	Actual Car (——)
Model Year 1976		
Structure	0	0
Wheel System	4	3
Propulsion System	8	14
Braking System	8	9
Steering System	1	2
Body	2	1
Communication System		
Model Year 1974		
Structure	0	0
Wheel System	10	7
Propulsion System	14	13
Braking System	22	26
Steering System	2	5
Body	4	4
Communication System	37	38



Source: Reference 45

FIGURE 5-8. SAMPLE DISPLAY OF WEAK POINTS OF ONE CAR, 1976 and 1974 MODELS. NOTE THE COMPARISON OF THE ACTUAL CAR AND THE AVERAGE CAR OF THE SAME MODEL YEAR.

a particular model year that have been inspected. Thus, 3 percent of the actual cars in the example (Figure 5-8) have wheel system defects, whereas 4 percent of all 1976 cars inspected have that same defect. Thus, the actual car is somewhat better than average in that particular category.

Training of Inspectors

SB emphasizes the need for good relations with the customer whose vehicle it is required to inspect. One means to achieve this goal is through the superior professional qualifications of the inspectors.

In order to become an inspector, a person has to have six years of experience as a mechanic. SB then puts him through an additional year of training. Finally, he must work for one year under the supervision of an inspector.

Many of the inspectors employed by SB are graduate engineers.

5.3.2.2 West Germany.- The following sections are based on "Paragraph 29" which governs the inspection procedures required by law in West Germany. For complete detail, the reader is referred to Reference 47.

Frequency of Inspection

Private automobiles are required to be inspected once every twenty-four months. However, there is an important exception to this rule. If a new car is inspected and repaired in an authorized privately owned repair station at yearly intervals, then the first required TÜV inspection takes place after forty-eight and not twenty-four months. Thus, the vehicle owner has the option to patronize an authorized repair station if he wants to avoid the first TÜV inspection. The forty-eight month TÜV inspection controls to some extent the adequacy of the prior yearly inspections and repairs performed by the authorized repair stations whose names appear in the vehicle papers.

The requirements that a repair station has to satisfy in order to become authorized are described in Reference 47.

Inspection Network (1977 Data)

The network consists of 456 inspection stations with a total of 991 lanes. Total employment is 3,328 persons exclusive of the administrative staff. The yearly number of inspections is over six million passenger cars. Since the vehicle population is approximately twenty-one million, the number of TÜV inspections is relatively small compared to Sweden. The reason for this is that many of the inspections are performed by the authorized repair stations.

Nature of the Inspection

Eight subsystems of the vehicle are subjected to inspection. Each subsystem is further broken down into a number of subcategories ranging from 3 to 32. For example, subsystem 8 (exhaust system) calls for the following checks:

- Visible emissions (smoke)
- CO
- Loose or damaged muffler and pipes
- Noise.

Table 5-9 lists the subsystems and indicates how many subcategories are checked.

The brake inspection includes a check of the brake-linings. In those cases where the drum does not have an inspection hole, the wheel is removed.

The defects found are classified as "minor" or "major". Minor defects are those that do not significantly degrade vehicle safety, do not cause any violation of the law and may

TABLE 5-9. FUNCTIONAL BREAKDOWN OF THE VEHICLE FOR PERIODIC INSPECTION IN WEST GERMANY

Subsystems	Number of subcategories checked
1. Accessories (e.g., mirrors)	18
2. Lighting	18
3. Steering	12
4. Brakes	30
5. Tires	3
6. Frame and suspension	32
7. Fire hazards	3
8. Exhaust system	5

be expected to be repaired promptly. Reference 47 lists a number of examples of minor defects. In the event major defects are found, the law requires prompt (within six weeks) repair and reinspection. Depending on the number and extent of major defects, the vehicles may be withdrawn from traffic. In many instances, the cost of the required repairs is such that the owner voluntarily withdraws the car.

The layout of the inspection facility, the degree of automation used and the organization of the inspection process vary greatly from state to state and even within one state. The Munich inspection facility visited in the course of this project had good equipment, but was not highly automated. The Düsseldorf facility, on the other hand, was highly automated and contained extensive digital sensing and data processing equipment. In both cases, the vehicles moved along an inspection line manned by several inspectors, some of whom were stationed in a workspace located under the car. In Munich, there were seven parallel lanes. The duration of the inspection was approximately 10-15 minutes.

Enforcement Methods

After successful inspection or reinspection, the vehicle is issued a sticker to be attached to the license plate. This sticker indicates the deadline for the next inspection.

Cost of the Inspection

The cost for a passenger car inspection is approximately six dollars; reinspection is three dollars.

Publication of the Inspection Results

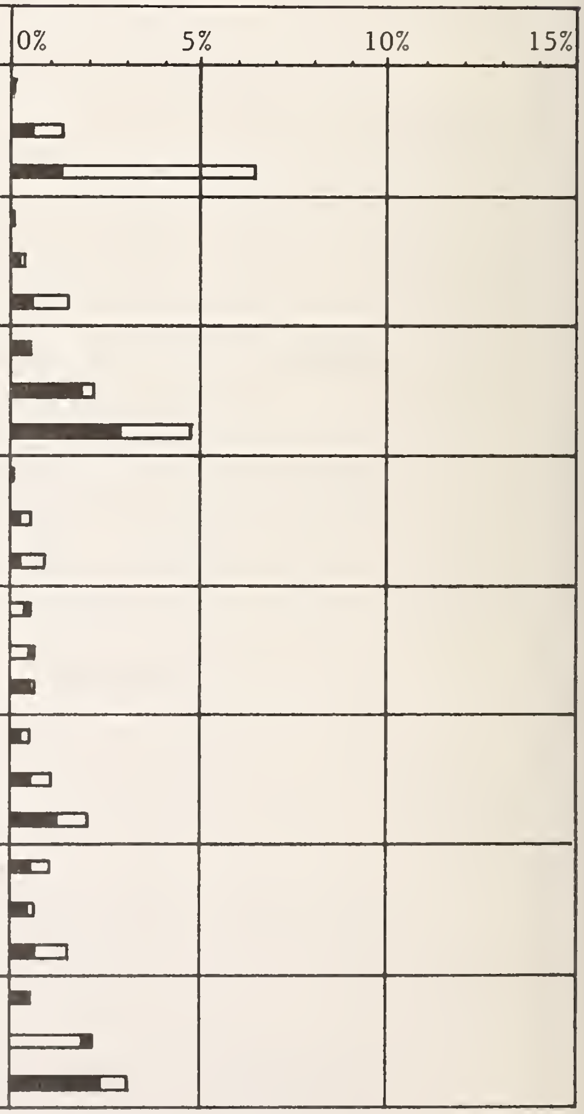
The number and type of defects observed by make and age is published every year by VdTÜV (Reference 51). Figure 5-9, taken from Reference 51, illustrates how detailed the report is.

% defective for car make tested

average % defects for vehicles of the same age tested

vehicle age (years)

Frame and Suspension	% defective for car make tested	average % defects for vehicles of the same age tested	vehicle age (years)
Frame, supporting structure: damage, corrosion	0.0	0.1	2
	0.5	1.2	4
	1.2	6.4	6
Frame and supporting structure inadequately repaired	0.1	0.1	2
	0.2	0.3	4
	0.5	1.4	6
Front suspension	0.5	0.5	2
	1.8	2.1	4
	2.8	4.8	6
Wheel Bearings	0.1	0.2	2
	0.2	0.4	4
	0.2	0.7	6
Driveshaft: boots	0.4	0.3	2
	0.6	0.4	4
	0.5	0.6	6
Looseness of steering assembly	0.2	0.4	2
	0.5	1.0	4
	1.2	2.0	6
Steering box: boots	0.1	0.5	2
	0.4	0.5	4
	0.5	1.3	6
Ball joints and tie rods	0.4	0.4	2
	2.1	1.8	4
	2.2	3.0	6



Source: Reference 51

signifies "better than average"
signifies "worse than average"

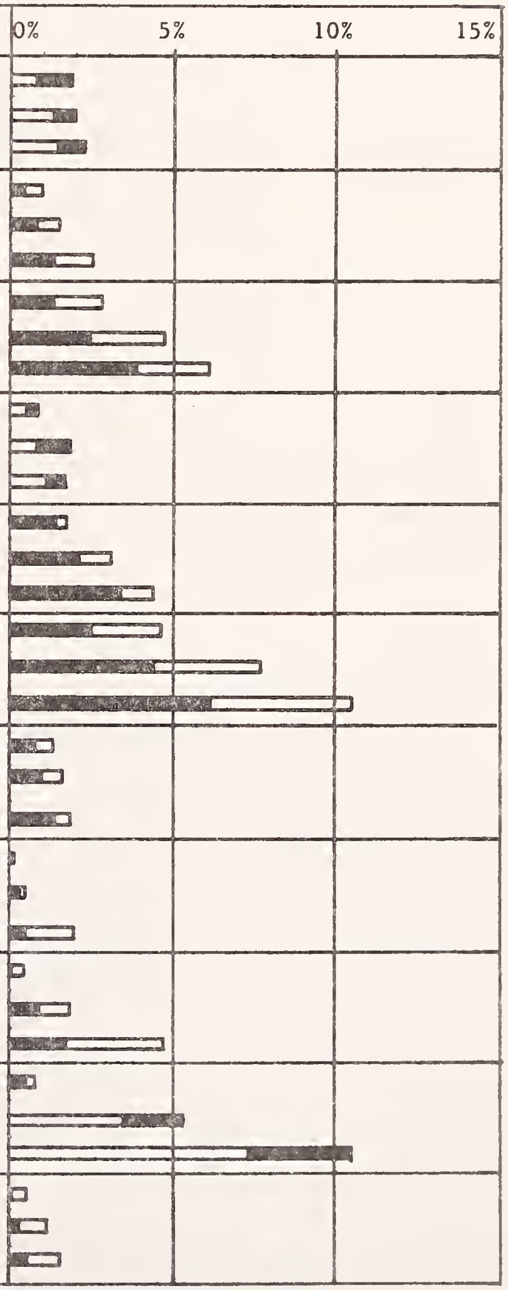
FIGURE 5-9. SAMPLE DISPLAY OF OBSERVED DEFECTS IN CARS OF SPECIFIC MAKE AND MODEL, 2, 4 and 6 YEARS OLD

% defective for car make tested

average % defects for vehicles of the same age tested

vehicle age (years)

Brakes	% defective for car make tested	average % defects for vehicles of the same age tested	vehicle age (years)
Footbrake: effectiveness	1.9	0.7	2
	2.0	1.2	4
	2.2	1.5	6
Footbrake: front uneven	0.4	1.0	2
	0.9	1.5	4
	1.2	2.5	6
Footbrake: rear uneven	1.3	2.7	2
	2.4	4.7	4
	3.9	6.1	6
Footbrake: pedal travel	0.8	0.5	2
	1.9	0.7	4
	1.7	1.1	6
Handbrake: effectiveness	1.4	1.7	2
	2.1	3.1	4
	3.3	4.4	6
Handbrake: uneven	2.6	4.7	2
	4.4	7.7	4
	6.1	10.5	6
Handbrake: travel	0.7	1.2	2
	1.0	1.6	4
	1.3	1.9	6
Power brake booster/ master cylinder	0.1	0.1	2
	0.3	0.4	4
	0.3	2.0	6
Hydraulic brake lines, front	0.1	0.3	2
	0.9	1.9	4
	1.7	4.8	6
Hydraulic brake lines, rear	0.5	0.8	2
	5.2	3.4	4
	10.4	7.2	6
Brake drums, brake disks	0.1	0.5	2
	0.2	1.1	4
	0.5	1.5	6



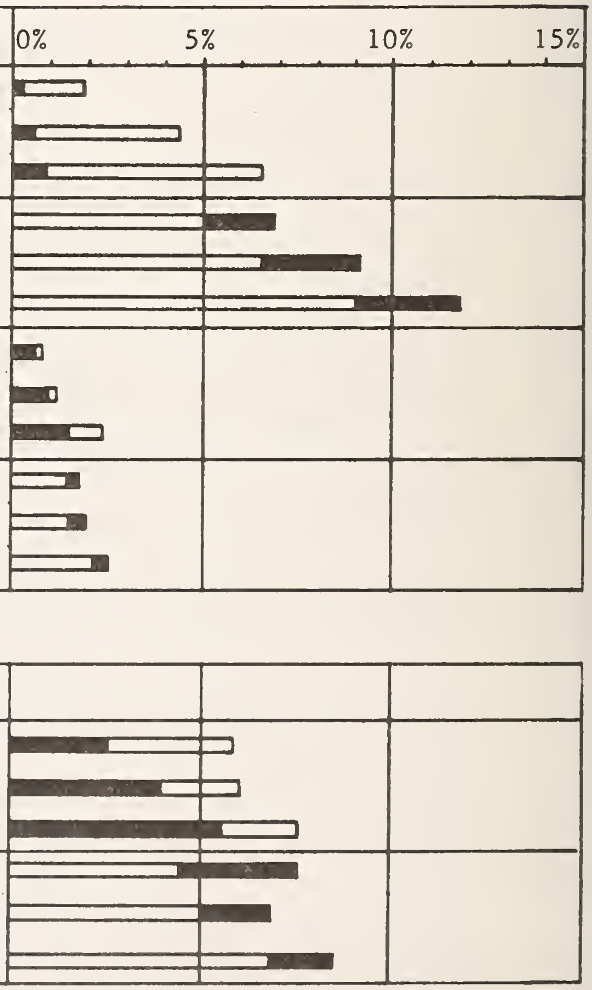
Source: Reference 51

signifies "better than average"
signifies "worse than average"

FIGURE 5-9. SAMPLE DISPLAY OF OBSERVED DEFECTS IN CARS OF SPECIFIC MAKE AND MODEL, 2, 4 AND 6 YEARS OLD (CONT.)

	% defective for car make tested	average % defects for vehicles of the same age tested	vehicle age (years)
Lighting System			
Headlight reflector	0.2	1.8	2
	0.5	4.3	4
	0.9	6.4	6
Low beam: adjustment	6.8	5.0	2
	9.1	6.5	4
	11.7	9.0	6
Tail lights: function and condition	0.5	0.7	2
	1.0	1.1	4
	1.3	2.2	6
Brake lights: function and condition	1.7	1.3	2
	1.9	1.4	4
	2.4	2.1	6

Emission and Noise			
Defective exhaust system	2.5	5.8	2
	4.0	6.0	4
	5.4	7.3	6
Emission test (CO)	7.5	4.5	2
	6.8	5.0	4
	8.2	6.8	6



Source: Reference 51

signifies "better than average"
signifies "worse than average"

FIGURE 5-9. SAMPLE DISPLAY OF OBSERVED DEFECTS IN CARS OF SPECIFIC MAKE AND MODEL, 2, 4 AND 6 YEARS OLD (CONT.)

Other Obvious Defects	Car Age in Years		
	2	4	6
Oil loss in engine and power train		●	●
Tires/tread depth			●
Other:			

Source: Reference 51

FIGURE 5-9. SAMPLE DISPLAY OF OBSERVED DEFECTS IN CARS OF SPECIFIC MAKE AND MODEL, 2, 4 AND 6 YEARS OLD (CONT.)

Classification of Defects by Age	Car Age in Years					
	2		4		6	
# of Vehicles Inspected	20,539		13,396		1,935	
	For Car Make	Average All Cars	For Car Make	Average All Cars	For Car Make	Average All Cars
Without defects (%)	59.7	60.7	48.2	47.9	42.2	34.5
Minor defects (%)	27.1	26.4	32.5	30.8	32.0	31.8
Major defects (%)	13.1	12.9	19.4	21.2	25.6	33.5
Unsafe (%)	0.1	0.0	0.1	0.1	0.2	0.2

Source: Reference 51

FIGURE 5-9. SAMPLE DISPLAY OF OBSERVED DEFECTS IN CARS OF SPECIFIC MAKE AND MODEL, 2, 4 AND 6 YEARS OLD (CONT.)

The following contrived example indicates how to interpret this report: assume that the report corresponds to a VW Golf. Then, the second row indicates that 0.5 percent of 4-year old Golfs have frame or supporting structure corrosion whereas 1.2 percent of all 4-year old cars tested in the Federal Republic have that same defect. Thus, the 4-year old Golf has better than average corrosion resistance.

Figure 5-10 constitutes another publicly available display of vehicle "quality" as measured by the percentage of vehicles that require reinspection; that is, those vehicles that showed up with at least one major defect. The width of the horizontal bar indicates statistical variability.

Figure 5-11 shows the average number of defect catagories of the West German passenger vehicle fleet in 1975 observed as a function of vehicle age.* Thus, vehicles of over six years of age have considerable defects about fifty percent of the time, even though these vehicles had been subjected to periodic inspection and mandatory repair. Most of the "considerable defects" would be related to vehicle safety.

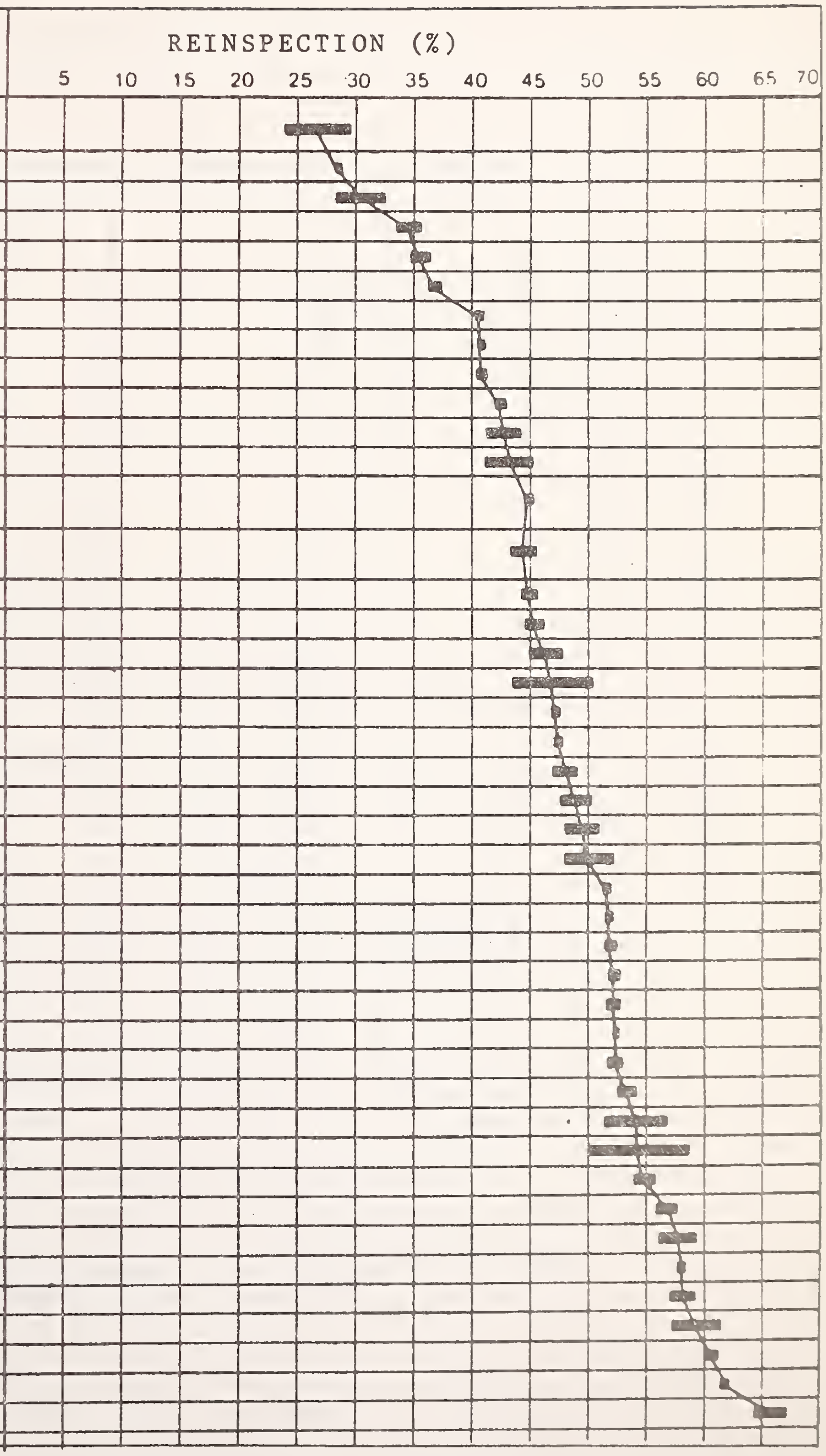
5.3.2.3 Comments on European Periodic Motor Vehicle Inspection Systems - Based on discussions with officials of the Swedish and West German inspection systems, the following additional comments are made:

<u>Processing and Publication of Inspection Results</u>

It is clear from the previous sections that the inspection process provides excellent data on the vehicle fleet. These data are not limited to safety and emission aspects, but also pertain to the fundamental vehicle data, such as type, age, chassis number and license number. The latter information is of great interest to the department responsible for motor vehicle

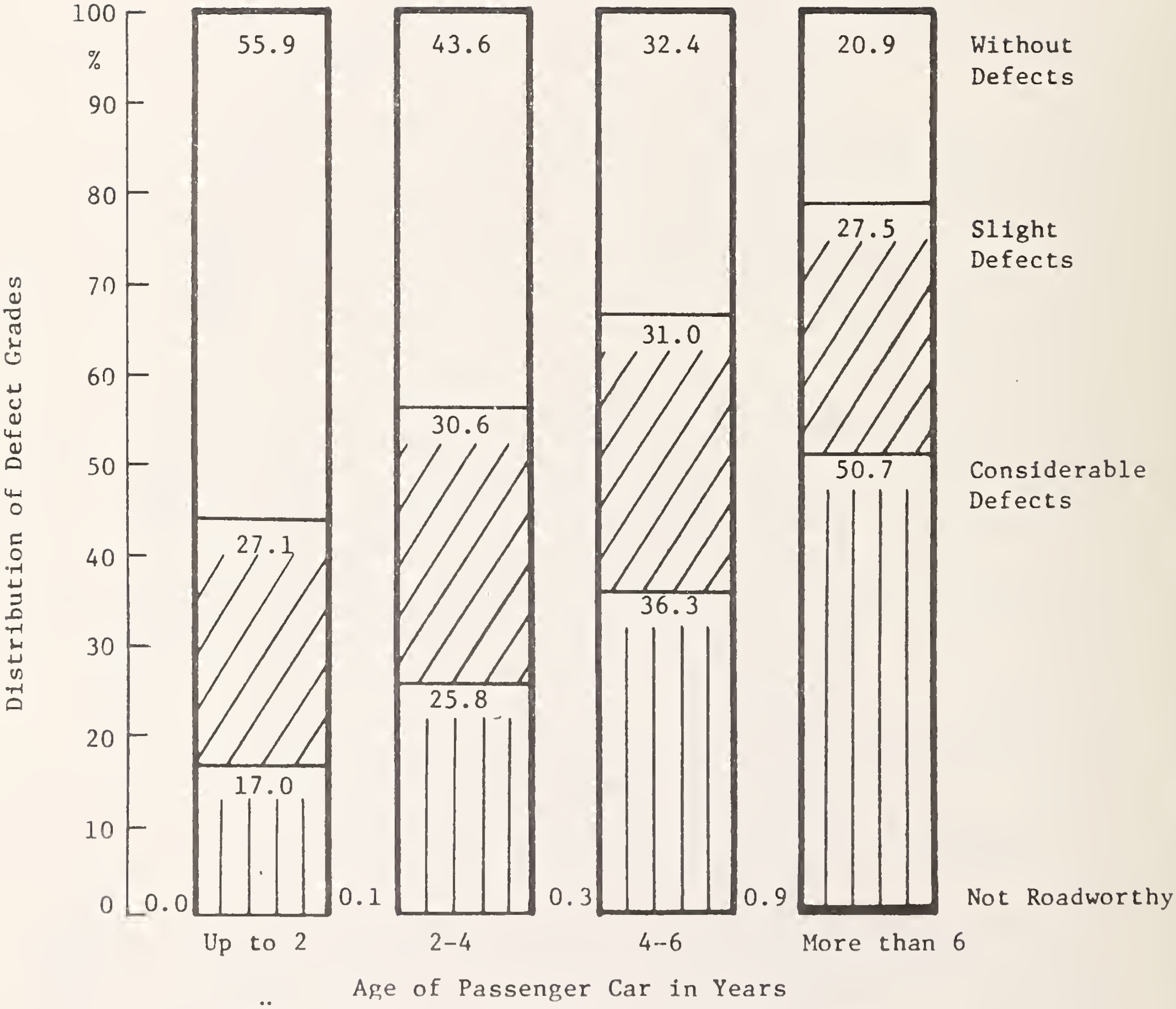
* TÜV Publication, February, 1977 (Second Edition)

Uber 6 Jahre	Ermittelte Wiedervorfahrtsquote
Daimler Benz 280 – 450 SL/SLC	24,1–29,9
VW Typ 1 (1302/1303 Kafer)	28,2–28,8
DAF 55/66	27,5–32,9
VW K 70	33,6–35,4
Renault 12	34,7–36,7
Opel Ascona-A	36,2–37,8
Daimler Benz 200/8 – 250/8	40,4–41,0
Audi 100/L/LS/C/GL	40,5–41,3
Ford Taunus	40,5–41,5
VW Typ 3	42,4–43,0
Peugeot 304	41,4–44,6
Citroen GS	41,2–45,4
Daimler Benz 200 D – 240 D/3,0	44,4–45,1
Volvo 142/144/145, 242 – 245	43,5–45,9
Opel Manta-A	44,5–45,9
Chrysler Simca 1100	44,8–46,7
Peugeot 504	45,2–48,2
Volvo 164, 264, 265	43,6–50,4
VW Typ 1	47,1–47,3
Opel Kadett B	47,3–47,7
Peugeot 204	47,1–49,7
Renault 6	47,9–50,5
Chrysler Simca 1000	48,3–51,1
Porsche 911/912	48,4–52,4
VW Typ 2 PKW	51,3–52,1
BMW 1502 – 2002/Touring	51,7–52,5
Renault 16	51,6–53,0
Ford Escort	52,0–53,0
BMW 2500/2800/3,0/3,3	51,8–53,2
Opel Rekord/Commodore	52,5–52,9
Fiat 128	51,8–53,7
Chrysler Simca 1301/1501	52,9–54,5
Autobianchi A 112/A 112 E	51,5–57,1
Skoda 100/110	50,1–59,3
Fiat 500	54,0–56,4
Ford Transit PKW	56,1–58,1
Citroen Dyane	56,7–59,9
Ford Capri	58,1–58,9
Fiat 124	57,9–59,8
Alfa Romeo Guilia	57,3–61,9
Citroen 2 CV	59,7–61,5
Renault 4	61,6–62,4
British Leyland Mini	64,8–67,6



Source: Reference 51

FIGURE 5-10. WEST GERMAN INSPECTION PROGRAM, PERCENTAGE OF REINSPECTION REQUIRED BY VEHICLES OLDER THAN 6 YEARS (1978 DATA)



Source: TÜV Publication, February, 1977 (Second Edition)

FIGURE 5-11. GRADING OF PASSENGER CAR DEFECTS BY AGE - WEST GERMANY (1975) registration and to the police.

Publication of the inspection results, as illustrated in the above tables, has a great impact upon consumers' perception of car quality and, thus, affects their buying decisions and future sales of specific makes/models.

Training of Inspectors

In West Germany, the law specifies the qualifications that a person must have before becoming an inspector. All inspectors with "full competence" are required to have engineering degrees; those with "partial competence" must have successfully completed training as master mechanics. In Sweden, similarly, high professional qualifications are demanded.

Voluntary Inspections

It is possible to request a voluntary inspection of the vehicle. There are several reasons for such inspections, for example:

- desire to sell the vehicle with an up-to-date inspection certificate
- desire to have the car checked and diagnosed for items not covered by the safety-oriented mandatory inspection.

Functional Inspections

It is very important to recognize that the mandatory inspections are functional, as opposed to diagnostic. That is, the inspector verifies that specific subsystems are able to perform their function as required; he does not attempt to diagnose why a specific subsystem does not perform satisfactorily, except, of course, in those numerous situations where the answer is obvious. The repair garages are responsible for diagnosis.

5.3.3 Impact of the Motor Vehicle Inspection System on the Auto Industry and Aftermarket

5.3.3.1 Impact on Auto Industry - The manufacturers are vitally interested in favorable inspection results of their products in order to improve future sales. The inspection reports described above are one source of information that identifies a vehicle's weak points in need of correction. Thus, strong marketing forces are brought to bear on the manufacturers, compelling them to improve or change the design of their products.

5.3.3.2 Impact on the Maintenance and Repair Industry - No major impact of periodic inspection upon the maintenance and repair industry was reported. It appears that the industry has the capacity to perform the required repairs and the ability to do so without the need for bothersome second or third reinspections. It is fully recognized that the consumer and the inspecting organization would react adversely to unsuccessful repair and the resulting "ping-pong" effect between repair shop and inspection station.

It was mentioned earlier that in West Germany the repair industry performs many of the inspections and required repairs in accordance with TÜV standards. This has undoubtedly led to an upgrading of the quality of the repair industry.

It was pointed out in Sweden that mandatory engine tuning prior to an inspection, as one of the means to insure compliance with emission regulations, might exceed the capacity of the maintenance industry.

5.3.3.3 Impact on the Motor Vehicle Accessories Market - Periodic inspection, as practiced in Sweden and West Germany has great impact upon the accessory market, as follows:

- many accessories that alter the basic characteristics of the original vehicle are not permitted by law. Periodic inspection ensures that these accessories are not used.
- many manufacturers of permissible vehicle accessories welcome the official approval of their products. In West Germany, TÜV-approved accessories carry a TÜV label.

The inspection system has also brought about new accessories that allow certain vehicles to pass inspection. For example, special reinforcement panels to strengthen corroded bodies are available in West Germany.

5.3.3.4 Impact on the Used Car Market - Vehicle inspection provides some protection to the buyer of a used car, since major defects are identified and must be corrected at periodic intervals. It has become common practice for the seller to offer or the buyer to request a voluntary inspection prior to consummation of the sale.

5.3.3.5 Impact on Vehicle Age -[52] There is strong statistical evidence that the Swedish inspection system has contributed to increased expected vehicle life as a result of the required preventive maintenance. Average life has risen from ten to fourteen years since the introduction in 1965 of mandatory inspections.[52] This same reference also gives the average life for the major vehicle makes sold in Sweden.

5.3.4 <u>Comparison with Existing and Proposed United States Systems</u>

The existing and proposed United States inspection systems are discussed in detail in Section 3.6 of this report. The purpose of this section is to point out key similarities and differences.

5.3.4.1 Salient Points of Surveyed Foreign Inspection Systems -

Salient points are:

- Emphasis on Safety. Most of the inspection involves safety. There is increasing interest in inspections related to emissions and noise. Studies are underway in Sweden to identify instrumentation for these additional checks under load in an inspection station environment. No practical solution has been found to-date. At present, CO is measured at idle and excessive noise caused by a defective muffler is noted.

- Inspection by Disinterested Party. Most, but not all, foreign inspection systems are owned and operated by a party which does not benefit from the repairs that it specifies. In Sweden, the system is owned jointly by the government and various organizations that have commercial or other interest in the automobile. In West Germany, the system is owned and operated by TÜV, which is an independent non-profit organization. In both cases, the law specifies the work to be performed and the government monitors the quality achieved.

- Low Cost Design. The organizations that perform the inspections are usually non-profit; the inspection fees must cover the capital and operating costs. In order to keep costs low, the Swedish station designs tend to be simple and functional and the equipment (e.g., hoists) is off-the-shelf commercial gear with occasional modifications. In West Germany, the opinions differ on the optimum degree of mechanization and automation. Some stations rely on the experienced inspector, whereas others use expensive and often specially designed equipment, such as hoists and various types of automatic test gear. On the other hand, the automatic processing of inspection results to provide defect statistics and to update the vehicle register is widely accepted. Dynamometers are not used in Swedish and West German inspection stations.

- Professional Caliber of Personnel. The training and the professional qualifications of the inspection personnel is very high in Sweden and West Germany. The inspection organizations realize that the customer has to have complete confidence in order for the whole inspection concept to work.

- Uniformity of Standards and Procedures. Within one country, the standards applied during inspection are the same, although the actual inspection procedures may vary, as in the case of West Germany where almost all States have their own TÜV organizations. Moreover, the foreign inspection organizations coordinate their efforts toward more uniformity on the international level through the International Vehicle Inspection Committee.

- Functional Versus Diagnostic Testing. The foreign inspection systems avoid giving a diagnosis of the reasons why a subsystem failed its test. Diagnosis, they feel, is the responsibility of the repair shop. The ping-pong effect where a customer does not pass reinspection because the repair shop was unable to correctly diagnose and/or repair the defect was reported <u>not</u> to be a problem. One reason why there is no significant ping-pong effect appears to be the genuine desire on the part of the inspector and the repair industry to avoid customer inconvenience through harmonious cooperation. Another reason is that unsuccessful reinspection causes the repair shop to lose business and to get a bad name at TÜV; therefore, work required by TÜV is done with extra care.

- Defect Data Collection and Publication. There is no question that the collection of defect data by make and year and its publication is of great value to the auto manufacturer and the consumer. There is much evidence that the manufacturers do correct the defects identified in the inspection reports.

- Integration of Vehicle Data. The data acquired during vehicle inpsection are integrated with other data, such as insurance, tax, ownership information, etc., in a computerized file that is maintained in one location under the authority of the Ministry of Transport in Sweden and West Germany. This national file containing the data of each registered vehicle is very useful for a variety of purposes, e.g., vehicle statistics, crime prevention, enforcement of insurance and tax obligations, etc.

- Fuel Conservation. The foreign inspection systems surveyed do not appear to have any plans to check vehicle fuel economy. They feel that the present idle-mode CO measurement gives some clue that the engine needs to be tuned and that future improved emission inspections will also benefit fuel conservation.

- Spirit of Cooperation. The policy of the inspection organization in Sweden and West Germany is to serve and favorably impress the customer, who is required by law to have his vehicle inspected and possibly rejected. The observations of the project team suggest that the periodic vehicle inspection systems have by and large been well accepted by the public in both countries. The spirit of cooperation shown by the inspectors (for example, willingness to inspect fleets on week-ends to avoid week-day earning losses) has been helpful. The system also minimizes the time lost by the customer; for example, the inspection is usually by appointment; the customer does not have to personally take the inspection result to the Department of Motor Vehicles in order to receive his new registration sticker.

- Modification to the Original Vehicle. Accessories which could have an adverse effect on vehicle safety are not allowed; the owner may be stopped and fined if he installs non-approved accessories, modifies his vehicle or fails to have it adequately repaired after an accident.

5.3.4.2 Comparison with Existing United States Systems- The existing and proposed United States systems have been described in great detail in Section 3.6. It is recalled that there exist two types of inspection systems in the United States, namely PMVI (Periodic Motor Vehicle Inspection) which is safety oriented and is promulgated by NHTSA and I/M which is emission oriented and is promulgated by EPA.

The existing United States systems vary widely from state to state and, in some cases, within a state. For example, California does not have a mandatory safety inspection (PMVI), but has implemented an I/M program in the South Coast Air Basin in addition to the statewide Class A smog station program.

The inspection standards are uniform within the individual European countries surveyed. This is not the case in the United States where standards and procedures vary from state to state. Also, due to the difference of approaches used for both PMVI and I/M, the training and qualifications of the inspection personnel is not uniform and may range from indifferent to highly qualified. Within the European countries surveyed, the administration of the inspection programs is uniform. This has great impact on standards, procedures, enforcement, data collection and analysis and the ability to implement changes as required. In the United States, administrative responsibility may belong to the State Police, the Department of Motor Vehicles, the Department of Transportation, the Department of Consumer Affairs or the Air Quality Board.

In those states where an inspection system exists, the inspection work may be carried out by state or city operated entities, by profit-making but independent contractors to the state jurisdiction, or by authorized repair shops which have a financial interest, since they would normally perform the repairs that they identify.

Authorized repair shops may be advantageous from a convenience standpoint, but may not constitute the least cost approach unless there is periodic monitoring by a disinterested party, such as TÜV in relation to the West German authorized repair stations.

The United States has certainly taken greater steps to-date in maintaining ambient air quality than have West Germany or Sweden. However, the emerging emission-related inspections will most likely be added to the existing inspection programs. In the United States, the PMVI and I/M programs are distinct although some attempts are being made to merge them.

Two of the most beneficial features of the European inspection systems surveyed are the widespread publication of defect statistics and the integration of various vehicle related data. The U. S. PMVI standard requires that each state publish summaries of inspection station records at least annually, including tabulation by make and model of vehicle.[53] We are not aware of any U. S. publication comparable to those of TÜV or SB. Also, we are not aware of effective and widespread schemes for integrating all vehicle data, such as proof of insurance, serial numbers, vehicle license, registration card and observed defects.

5.4.4.3 Comparison with Proposed United States Systems - [14,54] The Motor Vehicle Information and Cost Savings Act of 1972 provided for five diagnostic demonstration stations of which the project team visited one. The diagnostic program was initiated primarily in response to the needs of consumers for quality repairs at reasonable cost. Results and difficulties encountered in the demonstration projects have been studied and documented.* The program is presently taking new directions with several studies and activities now underway or planned.

*"Safety Status Data Collection Methodology, Volume III, Technical Report on PMVI Experiment Design," DOT-HS-802 573, May 1977

There are several key characteristics of the diagnostics program:

- The inspection covers safety, emissions, and fuel conservation
- The inspection isolates, identifies, and defines the cause of vehicle outage or malfunction to the extent permitted by limited disassembly. It need not necessarily provide detailed repair instructions.

A contract study is now evaluating existing diagnostic concepts, including those being utilized in foreign countries, and will recommned how a diagnostic capability can best be included in State PMVI and I/M programs. To the extent that information could be provided through the International Motor Vehicle Inspection Committee, closer coordination with that body may be warranted.

Regarding tabulation and publication of selected statistics related to vehicle inspections, U.S. officials have stated that although they recognize the potential advantages of national vehicle inspection data collection, defect publication, and integration with other data, the variability of quality and lack of standardization among existing state inspection programs do not now permit such activity. Further legislation would probably be required, but little support for such legislation has thus far been identified.

5.4 EFFECTS OF DAMAGEABILITY ON INSURANCE RATES

5.4.1 The Impact of Automotive Design on Insurance Rates in the United States

5.4.1.1 Determination of Insurance Rates - The basing of insurance rates on vehicle design and its susceptibility to damage in the United States is best illustrated by the approach of the Allstate Insurance Company with its Make and Model Experience Rating Program begun in 1976. For forty-six automobiles of model year 1974 through 1979, Allstate now charges less for collision and comprehensive coverage, and for seventy two models more is charged. All other automobiles have loss experience near the average and no adjustment is made in their rates.

The Make and Model Program does not specifically isolate vehicle design and base insurance rates on certain design features. Instead, it investigates insurance claims by automobile make and model and then determines rates based on the actual losses experienced. This data does not indicate what causes the loss experience to be better or worse for a particular model. Vehicle design is undoubtedly a factor, but other factors would also be included such as type of driver, driving conditions, etc. New models do not have an established loss experience so they are rated the same as comparable models of previous years. Farmers Insurance Group is developing a system similar to Allstate's.

A minor exception to the Make and Model Experience approach has been Allstate's allowed reductions based purely on design features, such as air bags and damage-resistant bumpers.

Recently Allstate has adopted a more design-oriented approach in assigning rates by reducing them approximately fifteen percent for collision and thirty-five percent for comprehensive coverage on the 1980 GM-X Cars (Chevrolet Citation, Oldsmobile Omega, Buick Skylark, and Pontiac Phoenix). The rate reduction for collision is because the X Cars have design features that make them easier and consequently less costly to repair. Other design features should reduce theft and thus comprehensive coverage claims. These reductions are based strictly on design features, because no loss experience data exists for the X-Cars. Allstate, through its Tech-Cor auto-repair subsidiary, worked with GM (and with Automotive Service Councils and Equipment and Tool Institute) on damage and repair related design for incorporation into the X-Cars. Allstate hopes to extend this working relationship to other manufacturers.

5.4.1.2 Norms for Repair Costs - In the late 1960's, insurance companies in an attempt to hold down repair costs, gave up the traditional method of negotiating with repair shops to determine how much they would pay and began to establish their own norms. They set prices they would pay by using their own estimators to determine the number of hours required for a repair job and applying the area's "prevailing wage" rate. The cost of parts was also determined by the insurance companies. In addition, they channeled business to repair shops which had agreed in advance to accept the insurers' estimates. Due to a recent United States Supreme Court decision, however, this practice may come to an end. Insurance companies thought they were exempt form Federal antitrust laws under the McCarran-Ferguson Act of 1945, which exempts the insurance business to the extent that it is regulated by state law. The Supreme Court included autobody repair as one of the arrangements that is not immune from anti-trust.

5.4.1.3 Development of Repair Methods - Tech-Cor's short-range approach to the development of repair methods is production oriented; they operate a repair shop under conditions which an average or typical body repair shop would encounter. They determine the probelems faced by a typical shop and attempt to find solutions that do not require large capital investment or extensive training of repair technicians. An example is a vehicle with a plastic front section that normally would be repaired by replacing the section at a cost of $700-800. Tech-Cor developed a method to repair cracks and tears in the plastic at a fraction of that cost, benefiting both consumers and repair shops.

Tech-Cor disseminates the results of their research to auto body repair associations, body repair equipment manu-facturers, automobile manufacturers, and insurance companies. Tech-Cor has so far not performed any crash testing of vehicles, but plans to do so in the near future.

5.4.1.4 Vehicle Design and Repairability - Tech-Cor's long-range approach is to work with manufacturers to develop vehicle designs which would improve the ease and reduce the cost of accident repairs. As previously mentioned, they worked with GM in the design of X-Cars. They are presently working with Ford in a similar manner. An example of their work is a suggestion made to the manufacturers to segment body panels and fenders so that entire units need not be replaced in the most commonly occuring types of damage. Tech-Cor supplies information on new car design to its parent Allstate Company which then determines the effect (if any) on insurance rates.

5.4.2 Related Activities of Insurance Companies in West Germany and Sweden

German insurance companies are members of the Insurance Association "Haftpflicht und Schadensverband der Kraftverkehrs Versicherer" (HUK). Among other responsibilities, HUK administers vehicle classification and insurance rate structures.

Two major classifications are used by the German insurance industry:

Liability insurance. Vehicles are grouped by engine horsepower categories. As an example, the owner of a vehicle producing 50 hp pays a lower premium than the owner of a 150 hp automobile. Additional criteria are a vehicle owner's place of residence, profession, and accident record.

Collision insurance. Vehicles are grouped according to the average cost of repairs for that vehicle type and the average frequency of losses occuring to that vehicle class. By multiplying "average loss" and "frequency of losses," a factor called "loss expenditure" is arrived at. This factor is used to classify vehicle types into one of the various premium categories. Today, thirty-one different vehicle classifications are in use, to which all insurance companies must adhere by law. A special commission with representatives from HUK, the Federal

Commerce Department, and the Transportation Department reviews and determines the vehicle classifications. Prior to publication of the "Register of Vehicle Classes" (Typenklassen-Verzeichnis), auto manufacturers have the opportunity to request a change of classification for a given vehicle type.

The sharp increase in German car registration since World War II led to a corresponding increase in the number of damaged cars and the cost of their repairs.

In an attempt to slow this costly trend, Germany's largest vehicle insurance company (estimated 25 percent share of the vehicle insurance market), the Allianz Versicherungs Aktiengesellschaft in Berlin and Munich, decided to analyze accident repairs on a scientific basis. A center for accident research called "Allianz Zentrum fuer Technik GmbH, Institut Kfz-Technik" was established in 1971. This center was the first and only one of its kind in West Germany, and still is.

Initially, automobile manufacturers greeted this decision with skepticism: development of body repair methods had been their sole domain. Today, these early reservations have been forgotten and close cooperation exists between the Allianz Center and the manufacturers.

The activities of the Allianz Zentrum fuer Technik (hereafter referred to as AZT) falls into these major categories:

- Repair Techniques
- Basic Research
- Training.

The development of repair techniques, based on the performance of actual body repairs on a wide variety of automobiles, led to the establishment of a research section within the center.

Research concentrates on these areas:

Body Design Concepts

- Study of body parts deformation characteristics
- Study of body parts segmentation
  Objective: original body sections should be designed to facilitate ease and low cost of most frequent accident repairs

Body Design Details

- Placement of reference and anchor points on vehicle bodies for use with combination measuring/straightening equipment
- Openings for beating and straightening operations in area of double wall construction
- Bolt-on design for exposed, damage prone body parts
- Body contour design to facilitate section painting

Body Repair Parts (Sheet Metal)

- Identification of required parts segments and partial assemblies
- Exchangeability and interchangeability of parts

AZT today works closely with design, development and production departments of most German automobile manufacturers. As a result of AZT recommendations, many design features which facilitate body repairs are found in vehicles currently produced. Figures 5-12 and 5-13 are two examples.

The AZT is also involved in the development of computerized estimates for adjusters, in research in the area of vehicle diagnosis, and in on-site practical training of field personnel.

Interviews on retail and factory levels revealed a unanimous positive reaction to AZT endeavors. The ultimate beneficiary is and will continue to be, of course, the German motorist.

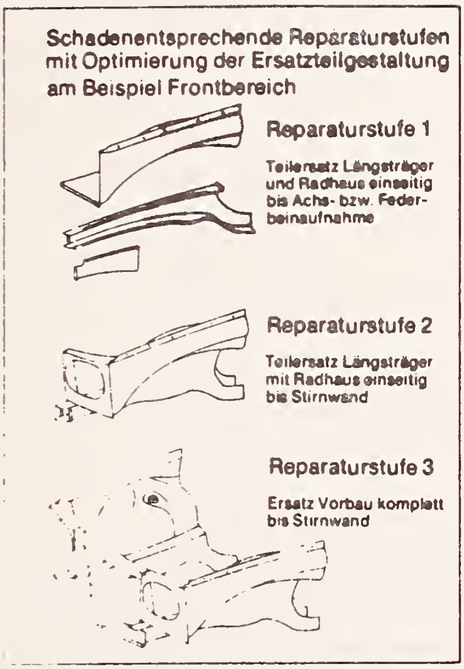


FIGURE 5-12.

THESE ASSEMBLY STAGES FOR VEHICLE FRONT SECTION ARE AVAILABLE. BODYSHOP ORDERS MOST SUITABLE ASSEMBLY FROM WAREHOUSE.

FIGURE 5-13.

REAR LEFT SIDE PANEL IS SEGMENTED, BODYSHOP CAN ORDER PARTS MOST SUITABLE FOR SPECIFIC REPAIR.

In the United Kingdom, as in Germany and Sweden, much attention is given to physical damage repair cost as it relates to automotive design and insurance rates. One organization very active in this area is the Motor Insurance Repair Research Center (MIRRC) at Thatcham, Berkshire. The MIRRC (known as Thatcham) was founded in 1970 by the insurance industry and the Corporation of Lloyds, and arose out of a desire of the British Insurance Association to offer technical guidance in order to reduce the cost of physical damage repairs. The insurance industry, auto manufacturers, and the repair industry acknowledge the work at Thatcham as being of significant benefit to the consumer in lowering repair costs and associated insurance rates.

Thatcham's objective is to perform research and provide information regarding:

- tools, equipment, and material used in repairing physical damage
- repair methods and uniform repair times
- vehicle design characteristics relevant to repair costs
- other factors found to influence insurance group ratings.

Through these activities, Thatcham identifies physical damage repair cost characteristics, both in a general sense and for specific vehicle models. Thatcham also contributes substantially to the classification of automobiles into specific insurance rating groups.

The group rating system used by United Kingdom insurance companies classifies vehicles into several groups in order to determine insurance rates. All vehicles sold in the United Kindgom are regularly evaluated using a detailed, multi-faceted rating formula. In addition to vehicle value and performance characteristics, the rating formula includes specific Thatcham data regarding:

- the cost and availability of frequently replaced parts
- repair times for frequently occurring types of damage.

The Thatcham data are heavily weighted in the rating formula, and their weight increases as vehicle value and performance increases. In the case of the most expensive group rating, the Thatcham input accounts for more than 50 percent of the total evaluation.

In addition to its work for the insurance industry, Thatcham provides automobile manufacturers and the repair community with the results of its research, and corresponding recommendations. Automotive manufacturers have proven themselves to be sensitive to the impact group ratings have on their cars' marketability. They have used Thatcham's research in their design efforts to reduce a car's repair cost, thereby lowering its group rating to a more favorable group. The preventive theme is again apparent in the research Thatcham has made available to the repair community regarding repair methodology, repair tools, equipment, and materials. The prevailing philosophy is that more effective methods, equipment, and materials will ultimately lower repair costs to the consumer.

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APPENDIX A

Report of New Technology

No new invention, discovery, innovation or improvement was made as a result of the work performed under this contract. The effort in this contract, however, did update and expand the information and data on the subject industry.

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